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OF
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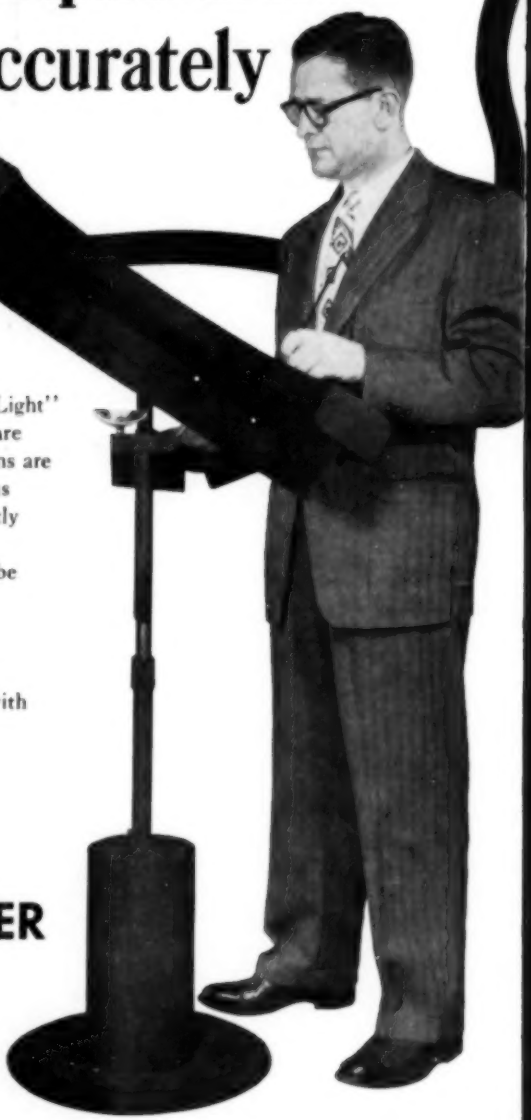

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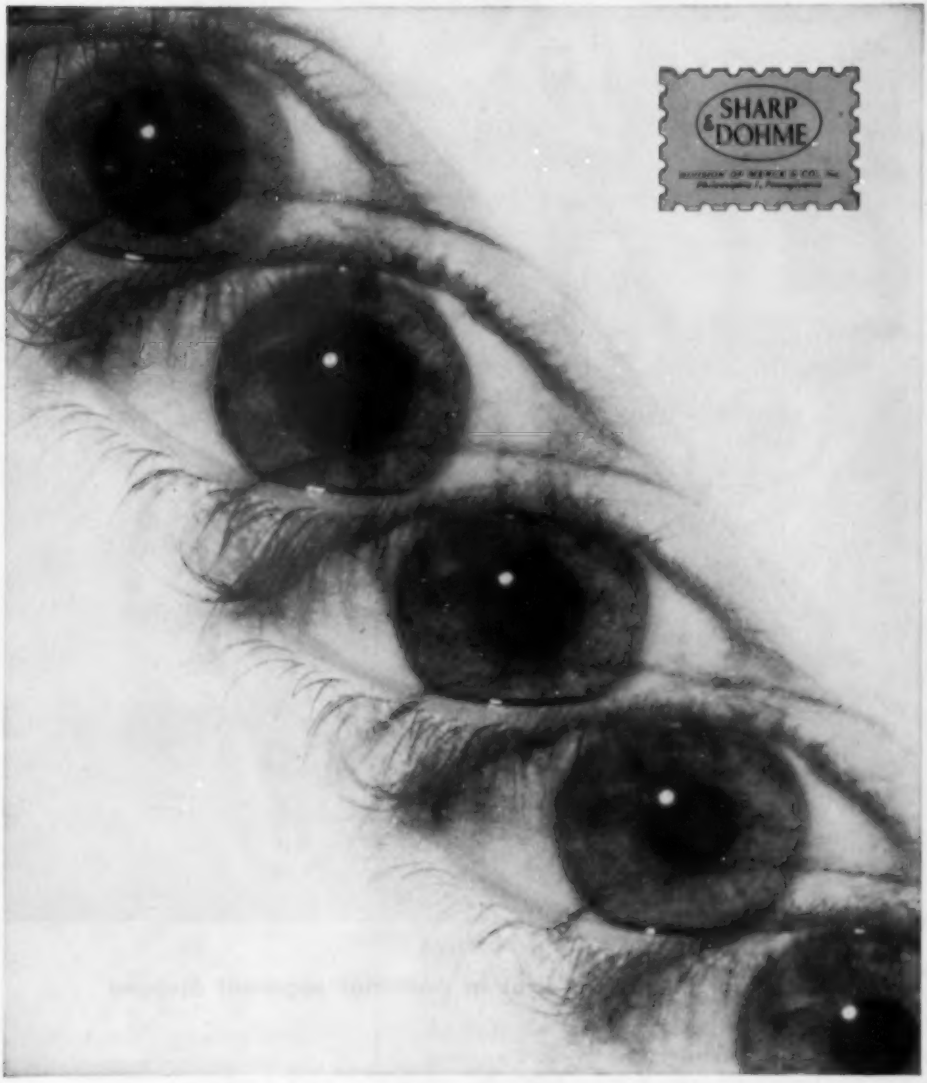

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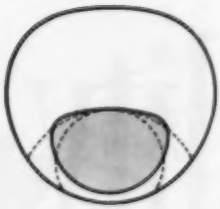

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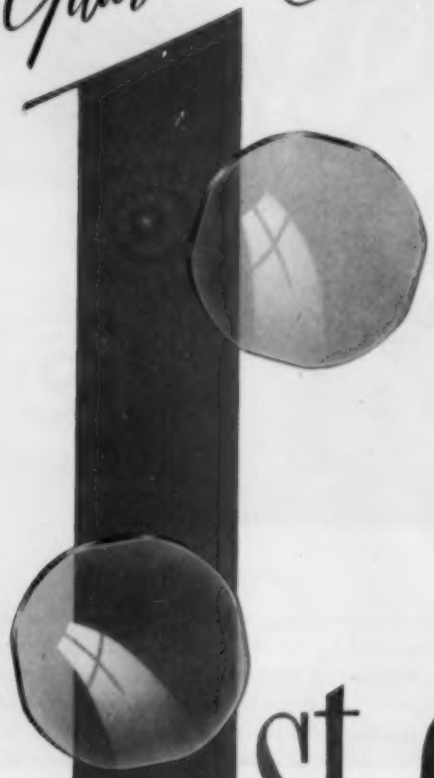

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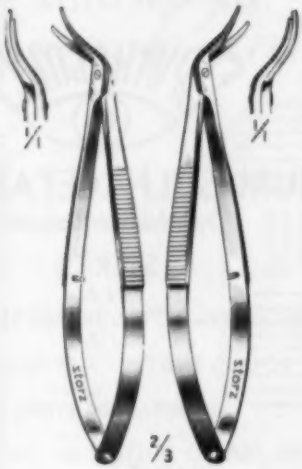

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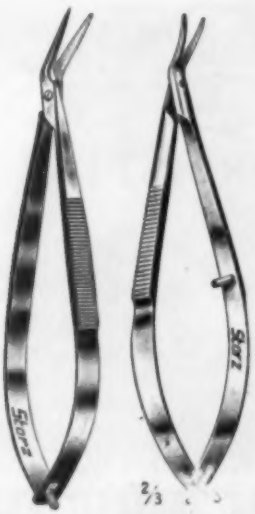

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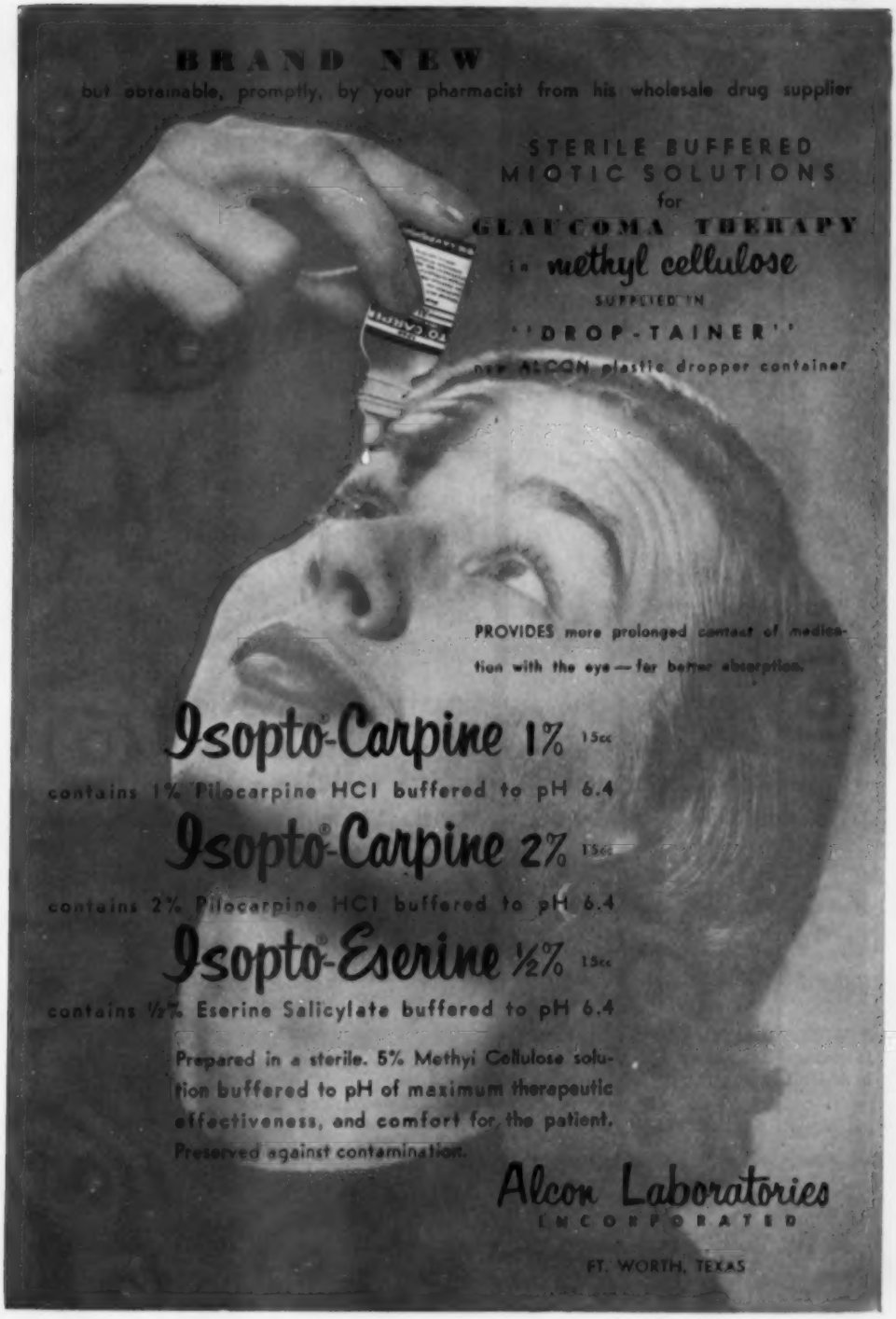
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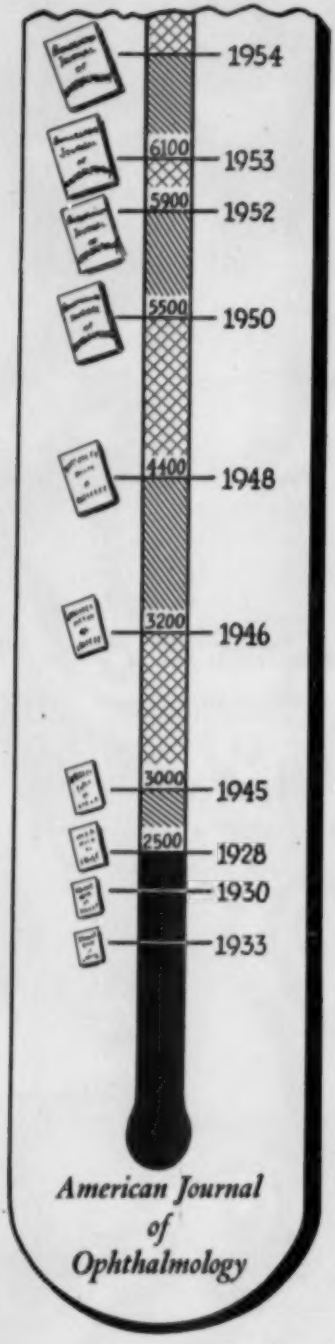
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1. Gettes, B. C., and Leopold, I. H.: A. M. A. Arch. of Ophth. 49:24 (Jan.) 1953.
2. Stolzar, I. H.: Am. J. Ophth. 36:110 (Jan.) 1953.

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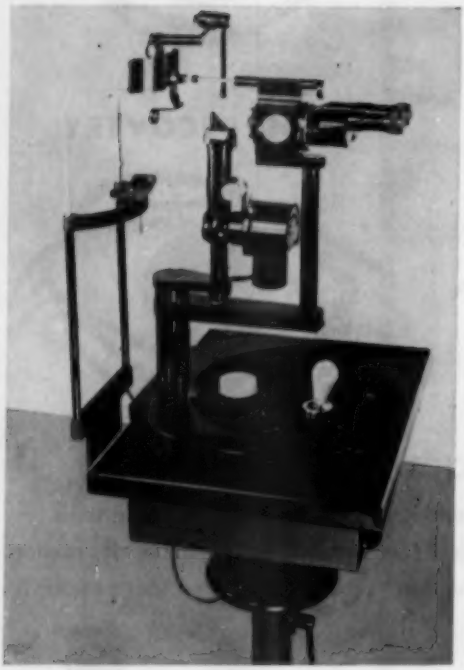

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ABSTRACTS

Anatomy, embryology, and comparative ophthalmology; General pathology, bacteriology, immunology; Vegetative physiology, biochemistry, pharmacology, toxicology; Physiologic optics, refraction, color vision; Diagnosis and therapy; Ocular motility; Conjunctiva, cornea, sclera 451

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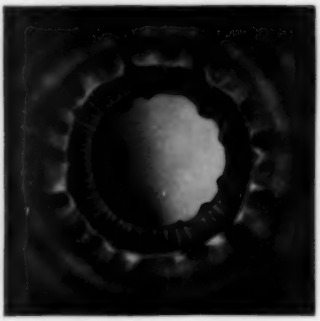

FIG. B

FIG. C

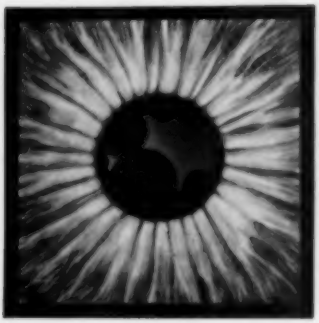

FIG. D

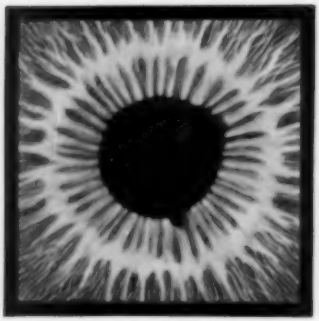

FIG. E

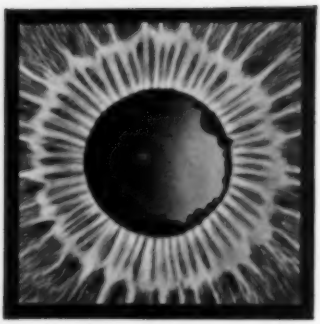

FIG. F

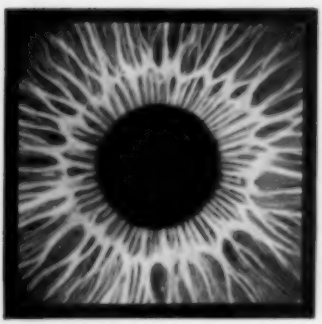

FIG. G

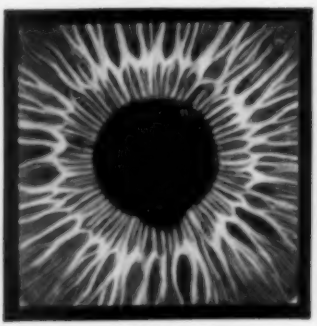

FIG. H

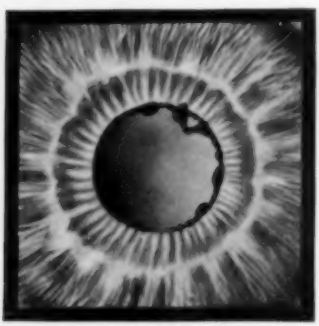

FIG. I

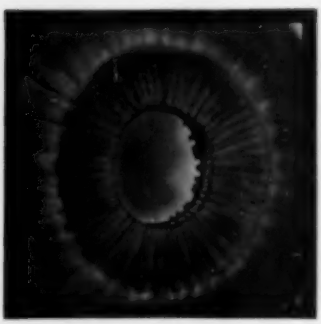

FIG. J

FIG. K

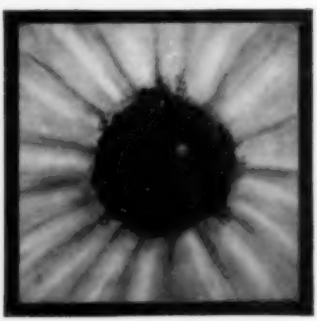

FIG. L

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INTRA-EPITHELIAL CYSTS OF THE IRIS

THEIR PRODUCTION IN YOUNG PERSONS AND POSSIBLE SIGNIFICANCE

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INTRODUCTION

Recently I[1] reported on finding cysts of the iris in young persons while using DFP (diisopropyl fluorophosphate) in the treatment of strabismus.[2] It was noted that certain cases under miotic therapy for strabismus developed large brown or chocolate-colored cysts along or behind the pupillary edge of the iris (color plate—fig. a). These masses projected into the anterior chamber, sometimes almost completely obstructing the pupil. Following these observations, similar cystic changes were intentionally produced and studied.

REPORT OF CASES

This report covers 66 cases of strabismus studied for DFP changes. Except for strabismus these patients showed normal eyes. The ages varied from two and one-fourth to 41 years. Of these 66 cases, 42 showed DFP-induced changes.

In these 42 cases, the average age was

Figs. a through l (Abraham). Intra-epithelial cysts of the iris.

(Fig. a) A girl, S. F., aged seven years. O.D., used 0.01-percent DFP for eight months then none for one month, and then again used drops for two months prior to date of this picture.

(Fig. b) Same case as Figure a, 19 days later. This interval without drops. O.S. showed picture similar to Figures a and b.

(Fig. c) A girl, A. A., aged four years. O.D., used 0.01-percent DFP for three and one-half months before cysts were noted. (None seen during first two-month period.) Used irregularly for three more months to time of drawing. O.S. almost identical. Note nasal vs. temporal involvement here and in Figure d.

(Fig. d) A girl, L. B., aged three years. O.S., used 0.05-percent DFP one to three times daily irregularly for one year. None three months and then again for six months until drawing made. The small masses represent tags not fully dilated. The tags were more numerous before the drops were last started.

(Fig. e) A boy, J. R., aged nine years. Used 0.05-percent DFP, O.D., only twice daily for one year. None for five months then used 0.02-percent solution for 11 months until drawing was made. Cysts and tags.

(Fig. f) Same as Figure d, after stopping drops for 36 days. Tags (++) smaller but still present seven months later.

(Fig. g) A boy, E. L. K., aged one and one-fourth years. Used 0.1-percent DFP every two days for eight months, reduced DFP then to 0.05 percent and continued use for one year. Reduced DFP to 0.01 percent twice daily and used for one year. Picture was almost identical with Mann's congenital cysts (fig. k) when first noted. Drawing was made after no drops were used for six weeks (child then four years old).

(Fig. h) Same as case in Figure g, 10 weeks later. No change three months later. Beginning to show "wrinkling" four months later.

(Fig. i) Unusual formation of tags, O.S. J. A., a girl aged five years. Used DFP for three years previous to stopping because of cyst formations. No drops for six months previous to drawing. Note similarity to flocculus.

(Fig. j) Pilocarpine cysts, M. H., a woman aged 71 years. Used pilocarpine hydrochloride (two-percent solution twice daily) O.D. for one and one-half years to time of drawing.

(Fig. k) Mann's case listed as congenital cysts of iris, due to incomplete closure of the marginal sinus of the iris. (From Mann.[3])

(Fig. l) Pilocarpine cyst of the pupillary pigment. (From Berliner.[4])

6.9 years, varying from two and one-half to 23 years. Only one patient was older than 14 years. In the 24 cases not showing definite slitlamp findings of changes, the average age was 7.9 years, varying from two and one-half to 41 years. Only one patient was over 12 years of age. The two groups were, therefore, definitely comparable as to age.

In 22 cases the patients were watched from the day DFP was started. Cysts appeared in about 10 weeks (average) varying from one to 40 weeks. In 11 of these cases, cysts appeared before the end of five weeks. Usually, whenever cysts were noted, the miosis was marked and definite, while an active pupil was noted in those cases not showing cysts. This suggested that a definite and prolonged miosis was required to aid in the formation of the cysts. While no cysts were noted in the many strabismus cases treated with pilocarpine or the few with eserine or Prostigmin, it is not unlikely that cysts could be produced by sufficient and frequent use of these drugs.

In all 42 cases showing cysts, these disappeared after discontinuing the DFP, leaving behind shrunken, shriveled, prunelike "tags." (See color plate, figs. b, f, h and i.) In the 22 cases observed from the onset, the cysts were found to disappear in two to 42 weeks after discontinuance of the DFP. In all but eight cases, the cysts were gone by the 10th week. In all but four cases the cysts were gone by the 15th week.

The tags, which were seen following loss of the cystic form, tended to become smaller and smaller with time. Entire disappearance of these tags on slitlamp examination was noted in 11 of the 22 cases observed from onset. In some, this occurred in as brief a time as four weeks from the date of discontinuance of the DFP. In some cases as long as 40 weeks were required for the disappearance. In 24 cases of the 42 in which changes had been observed, the tags were present to the last observation date, in some cases as long as two years after stopping the DFP. Most of these "tags" filled with fluid and became cystic on re-use of DFP (see color plate, figs. d and e).

The percentage of DFP used varied from 0.005 percent to 0.10 percent once or twice daily. In the 22 fully observed cases, 0.01 percent DFP was used once daily, usually in the mornings. The effect seemed more closely related to the miosis than to the strength of DFP used.

A tendency was noted for the cysts to appear first and chiefly in the nasal one-half of the pupillary margin in most of the cases. In only two cases did the temporal area seem favored. In only three cases were both temporal and nasal areas about equally involved.

Tensions were studied in 10 cases in which cysts developed. In no case was the tension above 22 mm. Hg (Schiøtz).

Literature

No literature has been found on similar clinical findings with DFP. Blankstein,[3] after a personal communication regarding these observations in October, 1952, wrote in March, 1953, that in "about 60 percent" of 20 cases of strabismus under his observation, using 0.025-percent DFP, small cysts developed at the pupillary margin of the iris. In one of his cases with a dislocated lens no such formations were noted.

Clinically similar cysts using pilocarpine and eserine have been described by Vogt.[4] He presented several cases of chronic glaucoma and one case of secondary glaucoma. In these cases cysts arose at or just behind the pupillary edge. The youngest patient he reported upon was aged 31 years. In one patient, aged 50 years, no miotics were used and no glaucoma was present. Vogt[4] mentions regressions and disappearance of the cysts and reappearance of new cysts in two years of observation.

Berliner[5] refers to these cysts as "pilocarpine cysts" and also mentions eserine as a possible factor. One of his cases showing

such a cyst is illustrated in the color plate, figure 1.

Thorpe[6] mentioned two such cases seen in consultation. In both, the cysts disappeared on stopping the drops. Givner[7] mentioned seeing one such case following at least 18 months' use of pilocarpine and DFP. Wexler[8] mentioned seeing one case and gave the following details:

> This is a case of chronic simple glaucoma in the right eye where 0.025 DFP was begun last May and used every second or third night. In July, the DFP was changed to 0.05. In November, the pigment overgrowth was noted on the temporal side of the sphincter but was interpreted to be ectropion uveae, but in the light of the present findings, this was the beginning of the present cyst. There is one definite cyst; the diagnosis is made with ease since there is a thinning of the pigment on the anterior surface, sufficient so that definite cystic formation is made out by retro-illumination. There is no evidence of iritis. There are two other pigment growths at the sphincter edge which for the moment do not appear cystic.
>
> As to the other eye, I did an iridencleisis about a year ago and there was immediate severe iritic response uncontrolled by medication, so much so that within a few weeks most of the pupillary area became occluded with a fibrotic exudate. This exudate was definitely a posterior iritis in the sense that the inflammation arose from the posterior iris surface and the iris quickly adhered to the lens. I had never encountered this in an iridencleisis and bring this point up for a definite reason, since it is apparent that this patient has the type of iris in which the pigment epithelium, both posterior and in the sphincter area, has a marked tendency to pigment proliferation so that when surgery is done the iris reacts in this typical way.

In three cases of glaucoma in adults, I have seen moderate-sized cysts following prolonged use of DFP. These patients, respectively, were aged 58, 70, and 73 years. In only one case was more than one cyst noted. In this case there were two small cysts in addition to the larger cyst.

In a few of the adult cases in which cysts were produced by DFP or pilocarpine the cysts were similar in size or number to those seen in the younger age group covered in this report.

Scholz,[9] working with DFP on rabbits (1946), reported histologic changes as follows:

> Histologic examination of eyes removed during the period of elevated tension showed epithelial blisters on the ciliary processes, engorgement of the iris and ciliary vessels, coagulated protein in the posterior and anterior chambers. (The blisters he referred to "were typical Greeff's vesicles" as illustrated by Samuels and Fuchs.[10]) It is the type of vesicle which can be artificially produced by a large paracentesis on a rabbit's eye. The quick decompression apparently enables the epithelium to be filled from behind the vesicles formed. Perhaps the same mechanism takes place in the use of DFP, in that a sublowering of tension is brought about causing the formation of these vesicles.[9]

These changes are similar to those described by Friedenwald and Pierce[11] in experimental glaucoma using histamine. Spontaneous cysts of the posterior surface of the iris and the ciliary body have been described in eyes removed on suspicion of malignancy and in eyes showing malignancy in other parts of the eyes, Reese,[12] Pagenstecher,[13] Vail and Merz.[14] Similar cysts have been noted after trauma, Roth and Geiger.[15] Similar changes have been described in diabetes and ocular inflammation, Reese,[12] Cordes,[16] Mayou.[17]

Samuels and Fuchs[10a] say: "When the iris is pushed forward by the aqueous in the posterior chamber large areas of separation between the anterior and posterior layers may be formed. For other reasons, fluid may accumulate between the two sheaths of the pigment epithelium and cause dehiscent pseudocysts."

Reese[12a] describes intra-epithelial cysts of the ciliary body and the iris. He finds it "not uncommon" to see cysts of the ciliary body in "routine microscopic examinations of eyes removed for various causes." In the iris, the site of predilection, according to Reese, is "the pupillary area where the marginal sinus fails to close." The cysts of the ciliary body seem to be much more numerous. One of his cases shows a solitary cyst[12b] of the pupillary border similar to those herein reported.

Villiard and Dejean[18] describe the cysts as single or multiple arising in the valleys between the ciliary processes. They consider these cysts as localized separations of the

two epithelial layers. These cysts are filled with clear fluid. Secondary glaucoma is frequently present in these cases. Reese's[12] cases support this observation as do Vogt's[4] cases. Pagenstecher[13] reports a similar case of multiple cysts of the iris and ciliary body in a mild case of glaucoma without treatment.

Vail and Merz[14] describe a spontaneous cyst of the iris and suggest an embryologic mode of formation. It is their feeling that spontaneous cysts of the iris are embryologic in origin and take place at about the 110-mm. or four-month stage. There is considerable traction by the zonular fibers on the ciliary epithelium of the valleys and lateral surfaces of the ciliary processes. The traction could and probably does reopen the potential space between the two layers of the optic cup. This, as briefly given, explains spontaneous cysts of the ciliary processes extending from the base of the iris to the pars plana. In their conclusion, Vail and Merz say that activity of the accommodation in later life may lead to changes in "size" of the cysts.

This thought regarding accommodation may fruitfully be further explored. Activity of accommodation and the iris sphincter may give rise to changes in the permeability of the vessels of the iris and ciliary body. This activity may give rise to a more or less rhythmic flow of fluid toward the canal of Schlemm, and in addition may *initiate* cysts as well as contribute to their increased size.

Summary

A study of cystic changes in the iris, coincidentally and later intentionally produced in humans by the use of DFP permits the following observations:

1. These cystic masses tend to occur with greater regularity and are larger in the younger patients.

2. These cystic changes are more likely to occur in those cases in which the pupils have maintained the miosis over a considerable period. The more active the pupil while under DFP therapy, the less likelihood is there that cystic masses will develop.

3. The cystic changes may be noted in the younger age group as early as two weeks after the initial use of the DFP.

4. The concentration of the drug is a factor only as this tends to control the intensity and duration of the miosis. A solution as weak as 0.005 percent of DFP can produce the changes noted.

5. The cystic changes vary in size from 0.1 mm. to 1.0 mm., approximately.

6. The number of cystlike masses also varies. Sometimes only one moderate-sized mass will be present, and then one may find as many as a dozen or more, almost completely filling the pupillary area.

7. In location these masses, thus far, have been seen chiefly in the pupillary area extending grapelike from the inner edge of the sphincter ring of pigment. The nasal one half of the pupillary rim was involved solely or chiefly in 77 percent of the cases with cyst-like masses that were studied—too many to assume such a localization accidental.

8. On discontinuing the DFP these cystic changes regress leaving dried prunelike "tags" or actually no slitlamp signs of their presence. This disappearance may be noted as early as two weeks following the discontinuance of the drug. In occasional cases, tags may be noted as long as two years following discontinuance of the drug.

9. These cystlike changes seem to have a definite relation to those seen in glaucomatous patients using pilocarpine.

Discussion

Duke-Elder[10] says we are in "no position to dogmatize . . . nor . . . are we certain to what extent the raised pressure is primary and to what extent it is secondary. . . ." In view of these words, a challenge to study the one major factor essentially unchanged in more than 75 years—the prolonged use of miotics as prescribed—may not seem too revolutionary an idea.

The physical changes in the iris and ciliary body which, it seems, are produced by the

use of miotics, together with the known chemical changes in the aqueous produced by miotics, suggest possible disadvantages in prolonged miotic therapy. It is suggested that the occasional case of acute glaucoma precipitated by DFP (Butler[20]) may be due to an engorged ciliary body or increased permeability of the ocular vessels with an increased protein content of the aqueous.

The degree to which ordinary accommodative action and miosis contribute to changed vascular states in an eye—the degree to which miotics increase any such effect—may justifiably be re-evaluated. Especially may this be true in eyes that show the changes of age which result in increased permeability.

Conclusions

Iris cysts of the posterior pupillary area have been intentionally produced in young persons by instilling weak solutions of DFP, usually once daily, in the conjunctival sac. These cysts are probably due to an accumulation of fluid between the epithelial layers of the iris—in the potential space of the marginal sinus.

Other cysts of the iris and of the ciliary body may also be present, though not noted in these clinical examinations in the cases reported.

The relation of these cysts to cysts seen in glaucoma is stressed and disadvantages to prolonged miotic therapy are suggested.

The possibility exists that the present method of prolonged miotic therapy in glaucoma tends to aggravate the already disturbed permeability and thus may lead to its own failure as a routine method of treatment. A preview of cases of glaucoma following surgery supports Vogt's observations regarding adhesions replacing cysts after glaucoma surgery. This may mean that surgery on eyes under prolonged miotic therapy may be more likely to be followed by adhesions and by complications leading to failure. Much more work is necessary to clarify these points.

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NARROW-ANGLE GLAUCOMA

Pupillary block and the narrow-angle mechanism

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It has been suggested in previous articles that primary glaucoma be classified into two fundamentally different groups on the basis of the findings in the chamber angle.[1-5] In the first group increased pressure is caused by closure of the angle by the root of the iris. Since this is preceded by narrowing of the angle, this type was termed "narrow-angle (iris-block) glaucoma." Cases in this group are actively or potentially congestive. In the second group the angle remains open and increased pressure appears to be the result of impediment to outflow localized within the trabeculum or angle wall (trabeculo-Schlemm's mechanism). For this group, the term "open- (or wide) angle glaucoma"* was suggested to distinguish it from the first.

This grouping has been commonly accepted and supported by Bangerter and Goldmann,[6] Sugar,[46] Kronfeld,[9,10] Chandler,[45] and others.[11] It has received further support from the quantitative functional tests of Goldmann[12] and the tonographic studies of Grant.[13]

Raeder[6] and Rosengren[7] had previously endeavored to group the glaucomas on an anatomic basis according to the axial depth of the anterior chamber. With the advent of gonioscopy and its combination with other clinical methods of examination, a more consistent grouping could be made on an anatomic or causal basis, namely on the findings in the chamber angle.

It is agreed that the time honored nomenclature of "congestive" and "noncongestive" or "simple" has the advantage of being clinically descriptive. However, in order to be adequate, it must be qualified as to its anatomic (causal) characteristics in individual cases. Moreover, the use of this nomenclature in the past has resulted in treating many cases of what can now be shown to have been narrow-angle (iris-block) glaucoma in the noncongestive phase (potentially congestive glaucomas) as "noncongestive" or "simple" glaucoma because they ran a clinically noncongestive course. The tendency to such confusion is inherent in the terminology.

I prefer the more direct approach of an anatomic classification since it permits less error in evaluation, prognosis, and choice of operation. Until a better classification and terminology can be found it appears to serve a useful purpose. The causal classification which was introduced by me and which is based on the findings in the angle will, therefore, be used in this and following articles. The terms "congestive" and "noncongestive" will be employed to indicate the clinical phase and course.

Method of Investigation

In most cases of narrow-angle glaucoma, gonioscopic examination shows a characteristic anterior displacement or convexity of the peripheral portion of the iris (ballooning or bombé).[2-5] In order to determine the incidence and to evaluate the significance of the peripheral bombé, a study of the peripheral iris was made in normal, nonglaucomatous eyes and in open-angle glaucoma. Its variations in relation to changes in the axial depth of the anterior chamber, refraction, and other factors were noted. Special attention was paid to the consideration of a functional seclusion of the pupil (increased pupillary block) as the cause of the bombé.

The present study was based on a method of gonioscopy using a Koeppe contact glass,

* The term "open-angle" is preferred to "wide-angle" as being more appropriate.[4] "Trabecular" glaucoma was also suggested for this group.

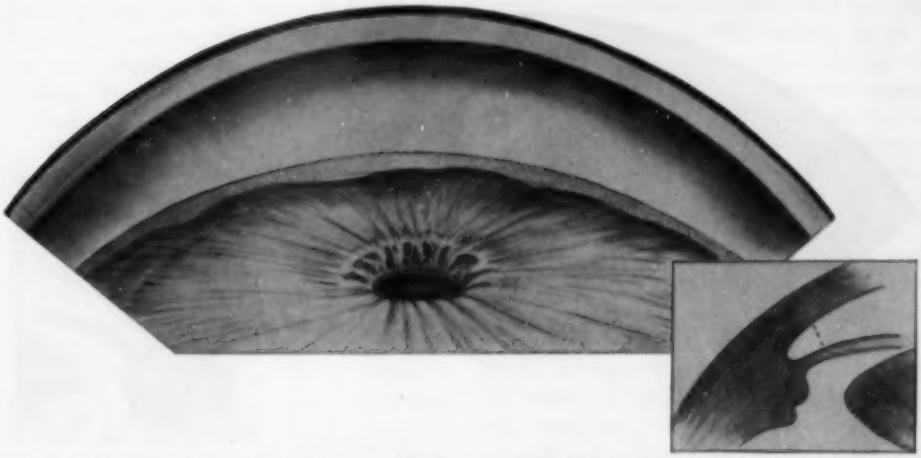

Fig. 1 (Otto Barkan). Physiologic seclusion of the pupil and ballooning of the iris in emmetropia or hypermetropia in which the axial depth of the anterior chamber was average or slightly shallow. Inset indicates width of angle.

focal illuminator,[14] and binocular microscope mounted by universal joints on an adjustable and movable stand, with the patient in the supine position.[1-2] Total magnification was 30 times. By means of the focal illuminator held in the hand, the incident beam of light can be given any desired direction. It permits examination by reflected light and by retro- and trans-illumination. Its brightness and flexibility are much greater than that of the slitlamps in use today. Its slit is optically imperfect since it consists of the image of the filament. Nevertheless, this method gives a markedly greater resolving power than those which employ a plastic lens with the patient sitting upright at the slitlamp microscope (Goldmann, Allen).

In addition to the usual slitlamp and other ocular examinations, the axial depth of the anterior chamber was measured with the Ulbrich drum. The range of error of repeated measurements was ± 0.1 mm. I have recently checked the measurements obtained with the Ulbrich drum with the apparatus of Stenstrom designed on the principle of Linstedt[15-16] and found the former to be within 0.1 mm. of the latter. One hundred nonglaucomatous eyes and 600 eyes with primary glaucoma were examined. Many of the latter were operative cases and were examined before and after iridectomy, trephining, iridencleisis, and cyclodialysis.

The depth and the configuration of the anterior chamber and the chamber angle were especially noted in relation to operations which opened the anterior chamber or perforated the iris. These conditions were compared in the operated and unoperated fellow eye.

Functional seclusion of the pupil (pupillary block) under physiologic conditions

Gonioscopy revealed that the iris in many eyes presents a convex or ballooned shape in the free peripheral region. This is most evident when the pupil is in miosis. In all eyes with emmetropia or hypermetropia in which the axial depth of the chamber was average or slightly shallow, some ballooning was present (fig. 1). From the convexity (bombé) the iris dipped backward to form the sinus of the angle. The convexity may be great enough to hide a part of the angle wall even in miosis (fig. 2). The convex appearance is most marked and most conveniently

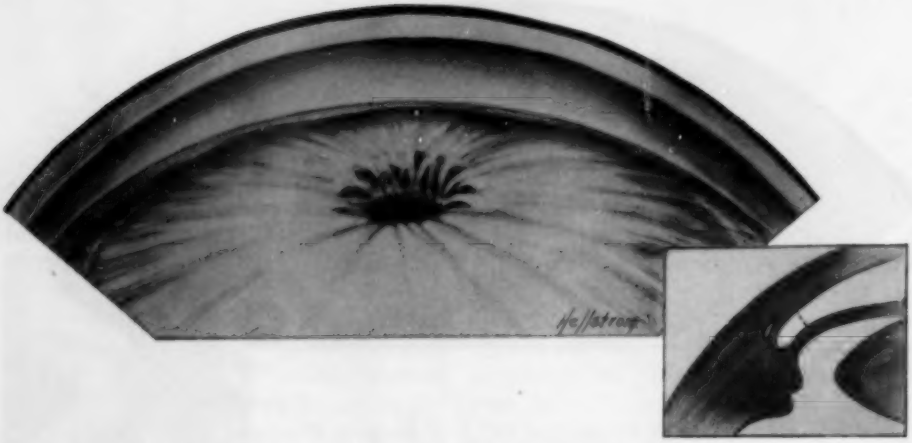

Fig. 2 (Otto Barkan). Physiologic seclusion of the pupil. The convexity of the iris (bombé) may be great enough to hide a part of the angle wall even in miosis. Inset indicates width of the angle.

observed in the lower circumference because the angle is physiologically wider there and the sinus is deeper.[17] The normal physiologic iridodonesis (observed at gonioscopy) in the midperipheral region of the iris that occurs on eye movements was absent or only slight; the circular iris furrows were less than in eyes with deeper chambers. These observations suggested that the iris was stretched because the pressure was greater behind than in front of the iris.

On the other hand, in myopic eyes and in eyes with greater than average axial depth of the anterior chamber (irrespective of refraction) there was no bombé, the plane of the iris was flat, the area of contact between

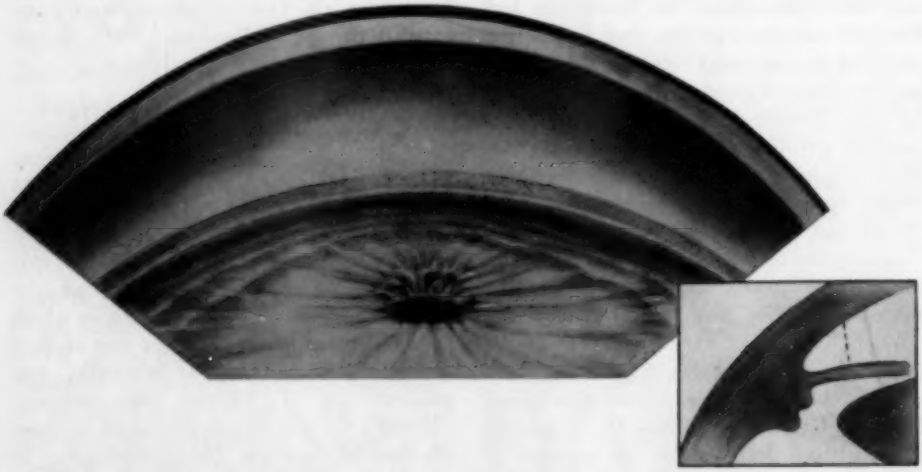

Fig. 3 (Otto Barkan). Absence of physiologic seclusion. In myopic eyes and in eyes with greater than average axial depth of the anterior chamber, there is no bombé, the plane of the iris is flat, the area of contact between pupillary region of the iris and lens appears less. There is more marked iridodonesis in the midperipheral region. The circular furrows of the iris are more marked.

pupillary region of the iris and lens appeared less, there was more marked iridodonesis in the midperipheral region, and the circular furrows of the iris were more marked (fig. 3).

Also, in children the bombé was less frequent and less marked since, in them, the average axial depth of the chamber was greater than in adults.[18] Incidentally, in a small series (50 children) the average corneal diameter was found to be slightly larger than in adults. This may indicate that the globe becomes smaller with age. It is interesting to note that Priestly Smith[19] found a slight diminution in the size of the cornea after 40 years of age.

In open-angle glaucoma, the same variations in the relationship between plane and shape of the iris (horizontal or oblique, flat or bombé), iridodonesis, iris furrows, and the axial depth of the anterior chamber and width of the angle occur as in normal, nonglaucomatous eyes.

Pupillary block in other conditions

My attention was first drawn to the delicate ball valvelike function of the pupillary lenticular orifice 15 years ago by the following clinical observations:

Two cases of incomplete circular adhesion of the pupil were observed in which miotics paradoxically produced increase in pressure. This was evidently the result of increasing the contact between the free portion of the pupil and lens. Mydriatics had the opposite effect and reduced the pressure.

In primary narrow-angle glaucoma it was observed that the convexity of the iris collapsed and flattened following peripheral iridectomy or iridotomy when performed through a self-sealing or trap-door incision,[3-5] thus confirming Curran's observation.[20]

In a case of secondary glaucoma[21] in which shallowing of the axial depth of the anterior chamber and increased contact between iris and lens were caused by a fibrous cord stretching between cornea and lens, severance of the cord permitted return of the lens to its normal position. This relieved the pupillary block and normalized the pressure by collapsing the bombé and opening the angle.

In cyclodialysis it was observed that a bubble of air over the pupil caused glaucoma by producing a pupillary block.[22] Injection of air into the anterior chamber in animal experiments produced the same results.[23] This occurred even if the tonometer indicated normal or subnormal pressure immediately following the injection of air, in which case there could have been only the slightest increase in contact between the sphincteric portion of the iris and lens. However, this slight increase in contact was sufficient to produce ballooning of the peripheral portion of the iris, closure of the angle, and glaucoma. Both in the human following surgery and in the animal experiment the ballooning process could be immediately reversed by shifting the position of the bubble from the pupil by positional adjustments of the head. As soon as a bit of pupil was exposed, the bombé of the iris collapsed. These experiences can only be explained by assuming that the increased pressure was caused by a bombé of the iris and closure of the angle due to an increase of purely physical contact between iris and lens.

A similar increase of purely physical contact producing a pupillary block appears to be the cause of the glaucoma in some aphakic eyes following constriction of a vitreous plug by the sphincter of the iris when there is no adequate peripheral iridectomy or iridotomy present[24] as recently emphasized by Chandler.[25]

In the foregoing it has been shown that the increase in iris bombé and the difference in pressure in front of and behind the iris producing it are caused by an increased seclusion of the pupil or pupillary block.

Pupillary block in narrow-angle (iris-block) glaucoma

The term "seclusio pupillae" has, in the past, generally been used only to denote

organic closure of the pupil as the result of posterior adhesions between iris and lens.

The question of a physiologic or functional seclusion of the pupil has, until recently, been given relatively little consideration in the literature. The cases of Ulbrich in 1908,[25] Heine[26] in 1913, and Urbanek[27] in 1922, in which a thinned area of the iris bulged forward, suggested an increase in pressure in the posterior chamber over that in the anterior. This could only be explained by resistance to free flow through the pupil.

Moreover, Panas[28] in 1884 and Knies[29] in 1893, who pierced the iris with the knife in congestive glaucoma and omitted the iridectomy (iridosclerotomy), regarded the increased communication between anterior and posterior chambers as a factor in the action of iridectomy.

In 1893, Pfluger[30] introduced peripheral iridectomy in order to obtain the benefits of iridosclerotomy without its hazards and technical difficulties. He remarked upon the fact that iridectomy enlarged the communication between anterior and posterior chambers.

In 1920, Curran[20] first made the clinical observation that the anterior chamber deepens in the region of an iridotomy or peripheral iridectomy performed through a self-sealing incision in cases in which the iris appeared to "hug the lens." He concluded that "the passage of aqueous through the pupil from the posterior to the anterior chamber is impeded on account of the iris hugging the lens over too great a surface extent."

In 1923, Baenziger[31] performed a small peripheral iridectomy with excellent result on a patient who had been suffering from prodromal attacks. He suggested that acute glaucoma is caused by increase of pressure in the posterior chamber as a result of which the root of the iris is pressed against the cornea.

In 1936, I confirmed these observations gonioscopically in cases of glaucoma operated upon by peripheral iridectomy through a self-sealing incision.[5-8] A preliminary deepening of the anterior chamber[5, 32] permitted a self-sealing corneal keratome incision to be made in many cases in which it otherwise would have been impossible. Following iridectomy the bombé of the iris collapsed and the angle widened throughout its circumference. It was concluded that an increased physiologic seclusion (relative pupillary block) was an active factor in the pathogenesis of "narrow-angle (iris-block) glaucoma" and that an important feature of the action of iridectomy was a short-circuiting of the seclusion with ensuing collapse of the iris bombé and opening and widening of the angle. Haas and Scheie[33] and Chandler[45] using the ab externo method have recently confirmed the effectiveness of peripheral iridectomy in narrow-angle glaucoma and corroborated the findings of Curran and of Barkan on seclusion of the pupil and its causal role in narrow-angle glaucoma.

Cause of pupillary block

What is the cause of the pupillary block (increased seclusion) in narrow-angle glaucoma? There are two main possibilities: Anterior position of the lens diaphragm, and disproportionately large size of the lens. Increased convexity of the anterior surface of the lens may be a factor in rare cases. Other factors which may influence the degree of seclusion are as yet purely speculative.

Anterior position of the lens as cause of increased seclusion of the pupil

The anterior position of the lens was suggested as a cause on the basis of various observations. It was demonstrated in my case of secondary glaucoma which was due to anterior displacement of the lens by traction of a fibrous cord connecting lens and cornea.[21] Operative severance of the cord resulted in retroplacement of the lens to its normal position, collapse of the bombé, opening of the angle, and normalization of pressure. This view is also supported by the variations of the seclusion and bombé which were found in nonglaucomatous eyes of varying axial anterior chamber depth.

As mentioned in the foregoing, in nonglaucomatous emmetropic and hyperopic eyes with relatively shallow axial anterior chamber depth, an increase of the physiologic seclusion was found, whereas in myopic and other eyes with a deep axial anterior chamber depth, the seclusion and ballooning were absent. This difference suggests that it is the relatively anterior position of the lens which produces the increased seclusion and, as will be shown, is prone to be self-intensifying.

Anterior position of the lens may be combined with other factors which predispose to a narrow-angle such as a small cornea, flattening of the peripheral cornea, enlarged ciliary body (hypermetropia, senescence), or developmental changes in the angle region.

Disproportionate size of the lens as cause of seclusion of the pupil

In cases of small corneal diameter the lens has been found to be disproportionately large; the lens is also known to increase in size with age.[10] Rosengren[7] found that the axial depth of the anterior chamber diminishes by 0.5 mm., probably as a result of the increased size of the lens. It may be that diminution in size of the cornea also encourages shallowing of the chamber. These factors encourage increased seclusion, bombé of the peripheral free portion of the iris, and narrowing of the angle in older people. Any one, or all of them combined may contribute to closure of the filtration angle by the root of the iris (iris-block glaucoma). However, they do not necessarily result in closure or iris block although they predispose to it. A rather marked bombé and narrowing of the angle may occasionally occur in normal eyes and in open-angle glaucoma.

The above observations explain why primary narrow-angle glaucoma does not occur in axial myopia or in infants, children, or youths (except in microphthalmos, cornea plana, or other congenital malformations).

Results of investigations in narrow-angle glaucoma

In the present investigations in most cases (80 percent) of primary narrow-angle glaucoma, both in the congestive and noncongestive phases, a markedly increased convexity (bombé) of the iris was observed.

Because of the clear cornea in the chronic noncongestive phase, gonioscopic studies were most conveniently made in them. In many cases the bombé, especially in the lower circumference, gave the impression of a bag of water and, if the axial depth of the anterior chamber was particularly shallow, it

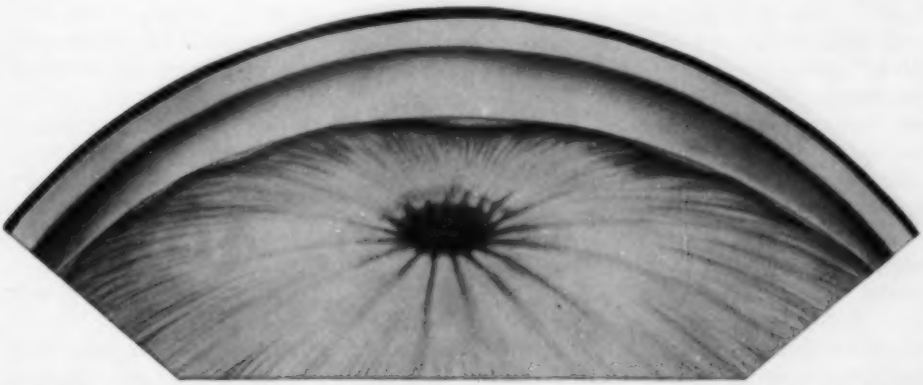

Fig. 4 (Otto Barkan). Seclusion of the pupil in narrow-angle glaucoma. In cases in which the axial depth of the anterior chamber is shallow, the bombé narrows the entrance of the angle to a mere slit and the contour of the iris hides the line of Schwalbe. Iris furrows are less and the iris has the appearance of being stretched.

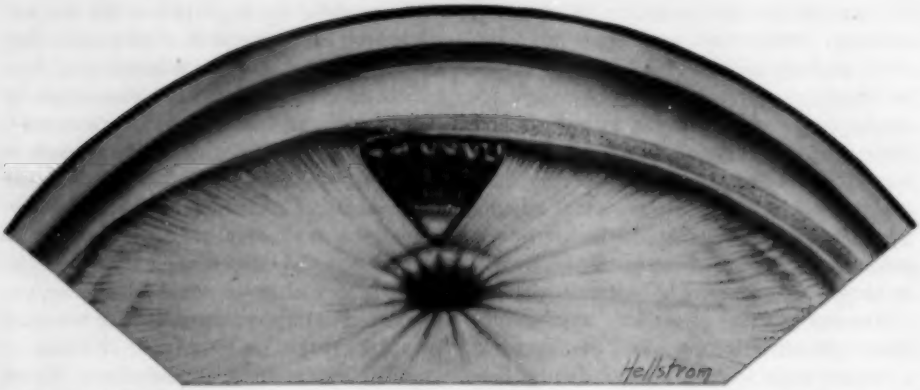

Fig. 5 (Otto Barkan). Postoperative gonioscopic view in the 12-o'clock meridian of the case shown preoperatively in Figure 4. Peripheral iridectomy through a self-sealing incision has collapsed the bombé and widened the angle except between the 11- and 12-o'clock positions where an adhesion was present. Note the anterior position of ciliary processes.

narrowed the entrance of the angle to a mere slit or the contour of the iris hid the line of Schwalbe (fig. 4). The iris furrows on the convexity of the bombé were less and the iris had the appearance of being stretched. This impression was confirmed by the absence of iridodonesis although occasionally a trace of a ripple on the summit of the convexity could be discerned on eye movements. The contour of the convexity may be slightly undulating, the depressions corresponding to the more firm radial vessels which divide its sectors. These observations were made while the eye was under the influence of miotics.

These findings in narrow-angle glaucoma suggest, as in the normal eye and in air glaucoma,[23] a difference in pressure in front of and behind the iris such as could only be caused by a pupillary block. That this is the case was confirmed by the changes following basal iridectomy and, to a lesser extent, any aperture (iridotomy) made in the free ciliary portion of the iris through a self-sealing or valve incision.

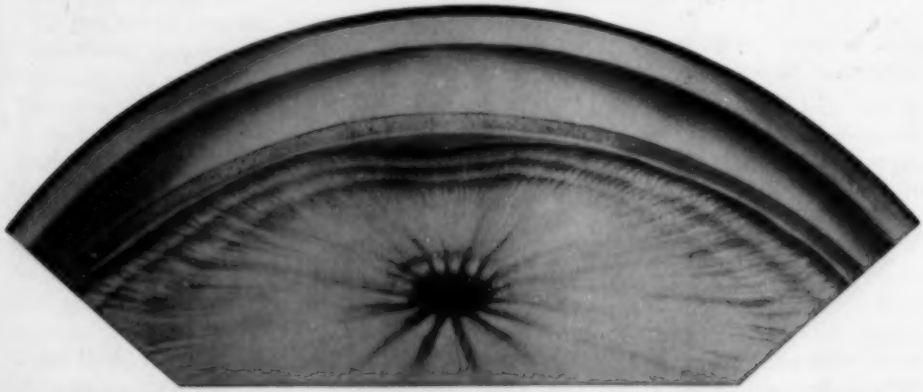

Fig. 6 (Otto Barkan). Postoperative gonioscopic view in the 6-o'clock meridian (same case as shown in Figures 4 and 5) shows collapse of bombé, widening the angle, and presence of iris furrows. The trabeculum is of normal appearance. The white line or band shown on the angle wall in these illustrations indicates the scleral spur.

Early in the series these changes were observed clearly and consistently only when iridectomy (peripheral or total) was performed through a valve or self-sealing corneal incision (figs. 5 and 6). Later in the series the same results were obtained by iridectomy ab externo making the incision very small where it enters the anterior chamber (not over 1.5 mm.) and by using a prelaid suture as recently emphasized by Chandler.[45]

In all cases of narrow-angle glaucoma which were operated upon with a sealed incision, there occurred a typical collapse of the bombé and consequent widening of the entrance to the angle throughout its circumference provided that the angle had not been previously closed by organic adhesions.

Postoperative organic adhesions can be shown to have been responsible for many failures in iridectomy performed in the past *without* a sealed incision. The leaking wound resulted in delayed reformation of the anterior chamber, and, when adhesions form, the iridectomy proves inadequate in the face of the trabecular block. The glaucoma could in fact be aggravated by the iridectomy.

In cases operated with a sealed incision pressure was normalized except in a certain number. In the latter group all cases showed evidence of trabecular damage, the result of previous contact with the root of the iris. This was suggested by the gonioscopic appearance of the trabeculum consisting of a secondary pigment band and reduced permeability to light (sclerosis) and by the reduced facility of outflow in the presence of an open angle. In the cases in which the appearance of the trabeculum and the facility of outflow were normal the pressure was effectively normalized by iridectomy.

It is interesting to compare the configuration of the anterior chamber in the eyes of a case of noncongestive narrow-angle glaucoma after a peripheral iridectomy has been performed on one eye. Gonioscopically there is a striking contrast between the bombé and narrow angle of the unoperated eye and the changed conditions (flat iris, collapsed bombé, and widened angle) in the operated eye (fig. 14). See also Figures 4, 5, and 6. This was illustrated by means of a model in a previous article.[3,4] As a result of the collapse of the bombé and of the observer lowering his line of vision to the plane of the flattened iris, the angle wall appears in a more vertical plane with consequently less foreshortening of the wall and better visibility. The increased axial depth which occurs in some cases encourages these phenomena. Attention has also been called to the difference in the angle in the operated and unoperated eye by Bangerter and Goldmann[8] and by Haas and Scheie.[32]

In some cases of acute congestive narrow-angle glaucoma, both with shallow and normal axial depth of the anterior chamber, the bombé was so extreme that the iris contacted the posterior surface of the cornea for a distance of one to two mm. axial to the line of Schwalbe, or well axial to the corneoscleral border. The congestive cases were operated upon by the ab externo method with peripheral or total iridectomy.

Changes in the axial depth of the anterior chamber

Decrease in the axial depth of the anterior chamber in the course of narrow-angle glaucoma

A gradual shallowing of the axial depth of the anterior chamber was observed and measured with the Ulbrich drum during the development of many cases of chronic noncongestive narrow-angle glaucoma over the course of years (fig. 9). These cases had been under the influence of miotics which, after a time, were not sufficient to control the tension. No previous report of a measured shallowing of the axial depth of the chamber has been found in the literature. Rosengren,[7] using the instrument of Linstedt,[10] measured one eye and did not find a shallowing over an observation period of one year. This progressive anterior displacement of the lens measured over the course of years in cases of narrow-angle glaucoma confirms

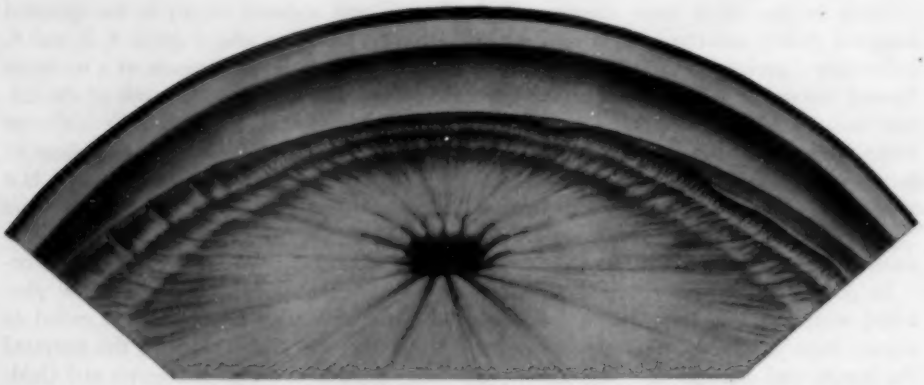

Fig. 7A (Otto Barkan). Narrow-angle glaucoma with normal axial depth of the anterior chamber. Preoperative gonioscopic appearance showing the angle partially closed by the last fold of iris contacting and advancing up the angle wall rather than closing it by the bombé contacting the line of Schwalbe as in Figure 4.

the clinical observation that a shallowing of the anterior chamber is an anatomic feature which is met sooner or later in many cases of glaucoma.[35]

All cases of primary narrow-angle (iris-block) glaucoma which have a shallow axial depth of the anterior chamber show seclusion of the pupil and bombé of the iris; in addition, the cornea is usually small. Gonioscopy through a surgical coloboma showed that the lens is relatively large in many cases in this group, as indicated by the narrowness of the perilental space and the frequency with which the tips of the ciliary processes project anteriorly to the equator of the lens. This is in marked contrast to the wide perilental space which was observed through a surgical coloboma is several cases of open-angle glaucoma in which iridectomy had been performed. Also, in several cases of narrow-angle glaucoma with normally deep axial anterior chamber depth and normal corneal diameter in which iridectomy had been performed, the perilental space appeared nor-

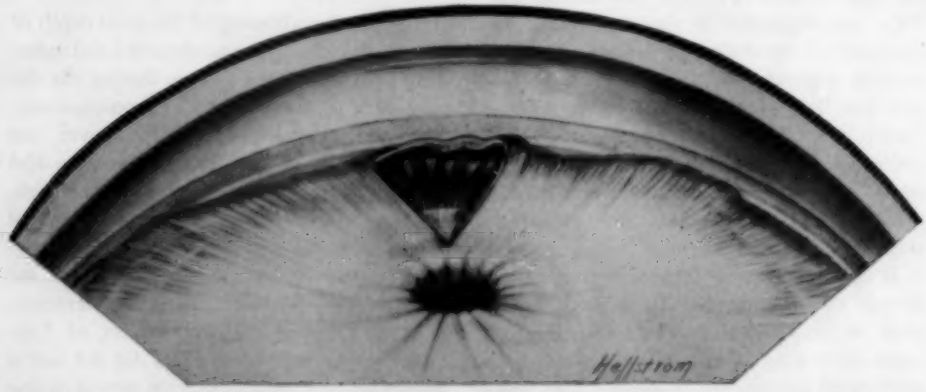

Fig. 7B (Otto Barkan). Postoperative gonioscopic view following peripheral iridectomy showing widening of the angle of the 12-o'clock position with normal appearing trabeculum exposed to aqueous. At the 11- and 12-o'clock positions the iris has remained adherent. At the 10:30-o'clock position, a secondary trabecular pigment band, the result of previous adhesion, is shown. Note the anterior position of ciliary processes.

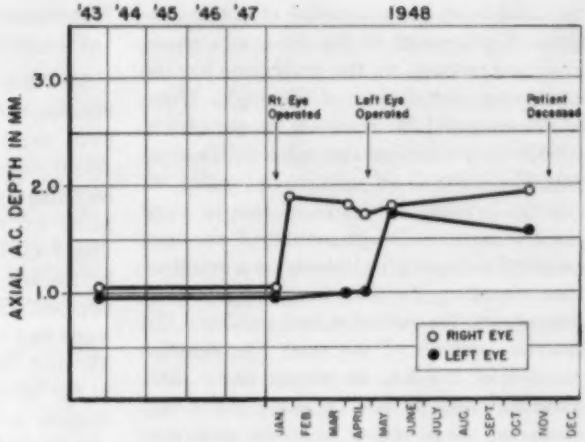

Fig. 8 (Otto Barkan). Graph illustrating increase in axial depth of the anterior chamber following iridectomy. This is a case of chronic narrow-angle glaucoma running a noncongestive course. The axial depth of the anterior chamber had been shallow preoperatively. The increase following iridectomy was immediate.

mally wide. Extraction of the cataractous lens from narrow-angle cases with shallow axial chamber depth and small cornea gives the impression of a lens which is disproportionately large.

In the present series it was only in cases with a shallow axial anterior chamber depth, seclusion, and bombé that the axial depth became progressively shallower in time. It was also only in them that the axial depth increased following peripheral iridectomy. The latter fact indicates that the shallowness of the axial depth of the anterior chamber is not solely the consequence of the large anteroposterior diameter (disproportionately large size) of the lens but must also be due to anterior displacement of the lens.

It is for this group of cases in which there is increased seclusion, bombé and anterior position of the lens that an explanation must be found for the changes in anteroposterior position of the lens-zonule diaphragm.

Increase in the Axial Depth of the Anterior Chamber Following Iridectomy

A deepening of the axial depth of the chamber, as measured by the Ulbrich drum, was observed in many cases of chronic noncongestive narrow-angle glaucoma following iridectomy (figs. 8 and 9). It occurred within a short span of time (days or weeks) or over the course of several months. A measured axial deepening of the chamber has not been previously reported following iridectomy or iridotomy.

In summary, a progressive shallowing of

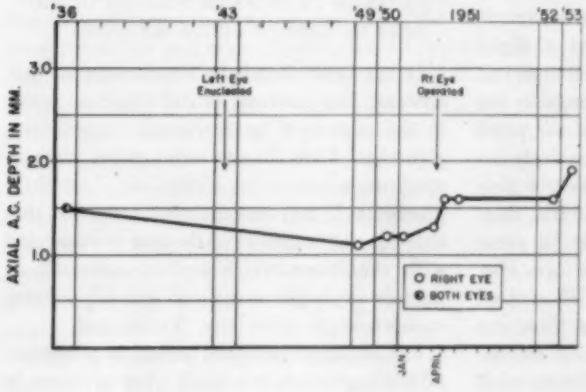

Fig. 9 (Otto Barkan). Graph showing the gradual shallowing of the axial depth of the anterior chamber during the development of narrow-angle glaucoma (noncongestive throughout while under miotic control).

the axial depth of the anterior chamber (anterior displacement of the lens) was measured and related to the seclusion, bombé, narrowing, and closure of the angle. These processes could be reversed by peripheral iridectomy performed through a self-sealing valvelike corneal or adequately sealed ab externo incision. It was noted that in some cases a posterior displacement of the lens occurred following iridectomy as a result of short-circuiting the seclusion. Apparently in these cases, the seclusion had produced the anterior position of the lens. *The anterior position of the lens in narrow-angle glaucoma may thus be both the cause and consequence of the increased seclusion. A vicious circle is created between anterior position of the lens and increased seclusion with ensuing closure of the angle.*

Pathogenesis of the narrow-angle mechanism

The evidence presented in the foregoing indicates that the anterior position of the lens or of the lens surface results in increased seclusion and bombé of the iris. There is, presumably, a ball-valve action between iris and lens which is increased when the latter is positioned anteriorly. Koster's experiments with a ball which fits into a hole of a membrane made of rubber are compatible with this.[26] From a theoretical point of view one would expect this tendency to be progressive. This is confirmed by clinical experience in the case of air glaucoma following cyclodialysis[22] and by air injection experiments in dogs[23] which show that a slight increase in the degree of contact between iris and lens or some other slight change in the physical condition in the region of the pupil may be sufficient to cause a progressively increasing seclusion, increased pressure differential in front of and behind the iris, closure of the angle, increased intraocular pressure, anterior displacement of the lens, and, thus, more seclusion. It is well illustrated in the previously mentioned case of glaucoma secondary to anterior displacement of the lens resulting from traction of a fibrous cord.

Narrow-angle glaucoma with normal axial depth of the anterior chamber

In some cases (20 percent) of chronic noncongestive narrow-angle glaucoma, the axial depth of the anterior chamber was found to be within normal limits, the corneal diameter was of average size, and the plane of the iris appeared relatively flat (fig. 7A). In these cases the angle was closed by the last fold of what appeared to be redundant iris contacting and advancing up the angle wall rather than by the convexity of the iris first contacting the line of Schwalbe as in the cases with more marked bombé and shallow axial depth of the chamber. They also reacted successfully to peripheral iridectomy and the angle widened (fig. 7B). This would indicate that in them also an increased seclusion of the pupil is involved although with slightly different gonioscopic manifestations.

Acute glaucoma may also occasionally have a normal axial depth of the anterior chamber even though the angle is closed. An explanation of this finding cannot yet be offered and must be the subject of further study. It may be that sudden closure of the entire angle locks the fluid in the anterior chamber. There may be predisposing changes which cannot be demonstrated, such as an enlarged ciliary body.

Seclusion of the pupil, expansion of the vitreous compartment, and antero-posterior changes in position of the lens in narrow-angle glaucoma

It has been shown by measurements that anterior displacement of the lens may occur in the course of narrow-angle (iris-block) glaucoma. This change never takes place in open-angle (non-iris-block or "simple") glaucoma. It may be concluded from this that anterior displacement of the lens is associated with conditions which are characteristic of narrow-angle glaucoma and are not present in open-angle glaucoma. These are:

1. Relatively increased seclusion of the pupil leading to iris bombé (higher pressure in

the posterior than in the anterior chamber).

2. Closure of the chamber angle which results in circulatory changes in iris and ciliary body and characteristic congestive symptoms.

3. Increased tension which is the result of closure of the angle by the root of the iris.

4. Increased rate of flow of intraocular fluid, from which increased formation of fluid may be inferred; that is, hypersecretion.

5. Expansion of the vitreous compartment by increased fluid content.

These conditions are reversed by peripheral iridectomy performed through a self-sealing corneal or with a tightly closed ab externo incision which short-circuits the seclusion and equalizes the pressure in posterior and anterior chambers. The bombé is collapsed, the angle is opened, the tension is reduced, and volume of the vitreous compartment is reduced as shown by retroplacement of the lens. Complete reversal only takes place before permanent adhesions have formed in the angle and while the trabeculum is still normally permeable.

The fact that the lens is displaced anteriorly in the course of narrow-angle glaucoma and that iridectomy corrects this by retroplacing it posteriorly leads one to seek and explain the mechanism by which this is accomplished. It appears fair to assume the premise that under physiologic conditions a constant relationship is maintained between the pressures in the posterior chamber and in the vitreous compartment. If this is true then a pupillary block which increases the pressure in the posterior chamber would result in increased pressure in the vitreous compartment. The latter would then be greater than that in the anterior chamber and would push the lens-zonule diaphragm forward. Iridectomy, by equalizing the pressures in the posterior and anterior chambers, would equalize the pressures between the vitreous compartment and the anterior chamber, thus reversing the process and deepening the anterior chamber.

Clinical evidence suggests that changes in pressure in the posterior chamber are linked to and control corresponding changes in the vitreous compartment. A common control of the formation of fluid both anterior and posterior to the zonule may also be postulated to explain how the pressures in posterior chamber and vitreous compartment are linked. This link may in part be reflex in nature. These explanations are compatible with expansion of the vitreous compartment by increased fluid content as the cause of the anterior displacement of the lens in narrow-angle glaucoma and its reversibility by peripheral iridectomy.

Since the events described above occur only in narrow-angle glaucoma and never in open-angle glaucoma, increased seclusion and closure of the angle, which is present in one and not in the other, appears to be the "trigger mechanism" which initiates the chain of events.

In summary, the most likely explanation of the anteroposterior changes in position of the lens in narrow-angle glaucoma is retention of aqueous behind the lens-zonular diaphragm (that is, in the vitreous compartment) induced by changes in the posterior chamber.

It is possible that in narrow-angle glaucoma an *increased formation of fluid* may be added to the factors mentioned in the foregoing. This was indicated by observations made in a case of narrow-angle glaucoma with malignant course operated upon by iridectomy. The anterior chamber remained flat and the tension high. Increased pressure in the vitreous compartment was proved by a spurt of fluid following posterior sclerotomy. In spite of repeated aspirations of fluid from the vitreous compartment increased pressure and absence of the anterior chamber continued over the course of an hour. This suggested that under the conditions there must have been increased formation of fluid posterior to the lens-zonule diaphragm.

Two cases of air glaucoma following cyclodialysis, one in my own experience and one seen in consultation, also showed signs of increased formation of fluid having been induced by the angle-block. Following several

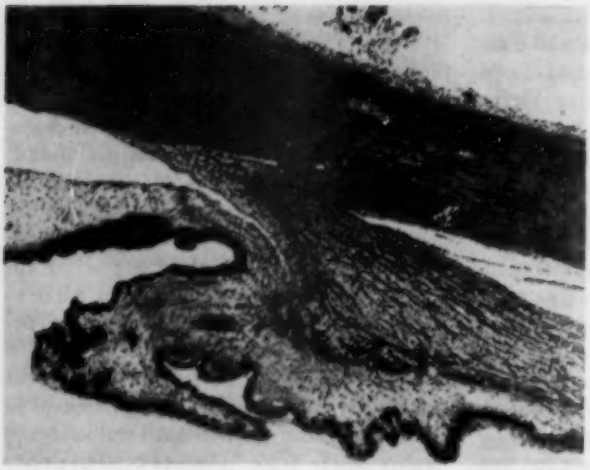

Fig. 10 (Otto Barkan). Recently formed anterior peripheral adhesion partially loosened by eserine.

paracenteses the anterior chamber reformed very quickly each time and the increased tension returned until in the course of 45 minutes the rate of secretion finally abated as indicated by the slower reformation of the chamber and the return to normal tension. By this time also the bombé had collapsed and most of the angle appeared open.

Elschnig states that pathologic anatomy does not help to establish the question of changes in the vitreous in glaucoma. However, he felt that an increase in volume of the vitreous compartment was indicated anatomically by those cases in which he found the vitreous pressed into the excavation of the optic nerve and those in which the hyaloid membrane was pushed into the posterior chamber almost like a hernia.

Nordenson[37,38] and Raeder[6] suggested that expansion of the vitreous compartment encourages anterior displacement of the lens. Nordenson postulated retention of fluid posterior to the zonule and found suggestive evidence in experiments of decreased permeability of the zonule in excised eyes. Since vitreous expansion by displacing the lens anteriorly increases seclusion, promotes closure of the angle, and increases intraocular pressure, it would support the theory of seclusion and its consequences which are presented in this article.

Outflow through the trabeculum is normal in narrow-angle glaucoma until the angle is closed or the permeability of the trabeculum is impaired through previous contact with the root of the iris. The thesis presented in the foregoing gains in plausibility in view of the fact that the trabeculum is initially normally permeable in narrow-angle glaucoma and that rapid outflow from the angle predisposes to a pressure differential between anterior and posterior chambers, hence between anterior chamber and vitreous compartment and thus to a forward displacement of the diaphragm.

Increased seclusion of the pupil as a cause of rotation of ciliary body and anterior displacement of the lens

In the foregoing it was shown how seclusion of the pupil may cause expansion of the vitreous compartment and anterior displacement of the lens by increasing pressure in the vitreous compartment, relative to that in the anterior chamber. Another possible mechanism must also be considered.

I have observed on gonioscopic observation through a peripheral coloboma in narrow-angle glaucoma that there is, in many cases, an anterior positioning of the ciliary

processes relative to the equator of the lens and an obliquity relative to the horizontal plane (figs. 5 and 7B). This position of the ciliary process, as seen through a surgical coloboma, is associated with and appears to be the result of the peripheral ballooning of the iris, as if the root of the iris had rotated the ciliary body on its axis. In these cases there were no peripheral adhesions which might have pulled the processes forward. The collapse of the bombé did not result in a return to normal position of the ciliary body, presumably because the malposition had become fixed and irreversible as a result of its long duration. *It is suggested that the rotation of the ciliary body and the resultant forward movement of the attachment of the zonule may be a factor in causing anterior position of the lens.* The anteriorly displaced lens would, then, by increasing the pupillary block, have a self-intensifying effect.

An anomalous position of the ciliary processes and of the ciliary body was noted by Elschnig in all cases[39] in anatomic sections of "incompensated glaucoma" (that is, narrow-angle iris-block glaucoma in the congestive phase). The posterior chamber was enlarged. There was no evidence in cases of recent onset of the ciliary processes pushing the iris forward. In two cases of recently "incompensated" (early acute) glaucoma Elschnig also found this anomalous position of the root of the iris. These findings give support for the theories presented in the foregoing on the role of pupillary block and angle closure as the trigger mechanism in the pathogenesis of narrow-angle glaucoma. He found no support for the theories of Weber,[40] Priestly Smith,[19] and others that swelling of the ciliary body and ciliary processes initially pushed the root of the iris forward, thus closing the angle. Elschnig's findings are summarized as follows:

> The iris turns outward sharply from its point of origin at the anterior inner edge of the ciliary body, proceeds along its surface, then bends in the form of an arc close to the pectinate ligament [trabeculum] and the inner corneal border. It forms, therefore, after a 180 degree turn, a full reduplication with the anterior surface of the ciliary body. The ciliary processes follow the pull of the iris in a forward and outward direction, sliding anteriorly along the ciliary body, the sharp inner anterior edge of the body being rounded off and the circular part of the ciliary muscle pulled anteriorly (figs. 10 and 11).
>
> The ciliary processes are pushed or pulled forward, across the inner surface of the ciliary body, following the pull of the root of the iris. As a result, the most anterior ciliary processes arise from the (formerly) anterior surface of the ciliary body pointing outward and forward from the inner edge

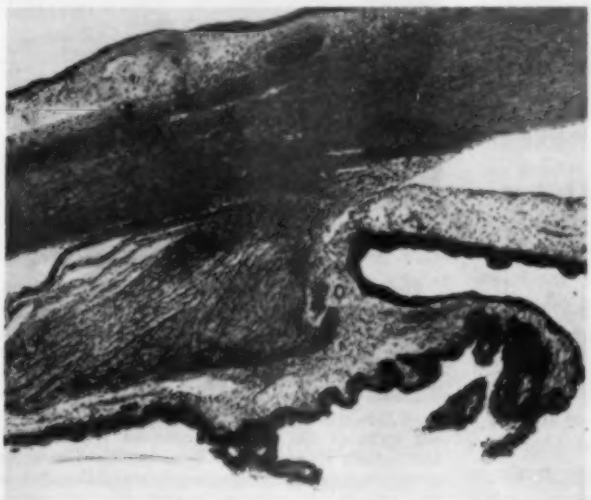

Fig. 11 (Otto Barkan). Opposite chamber angle (see fig. 10) showing delicate incomplete peripheral adhesion.

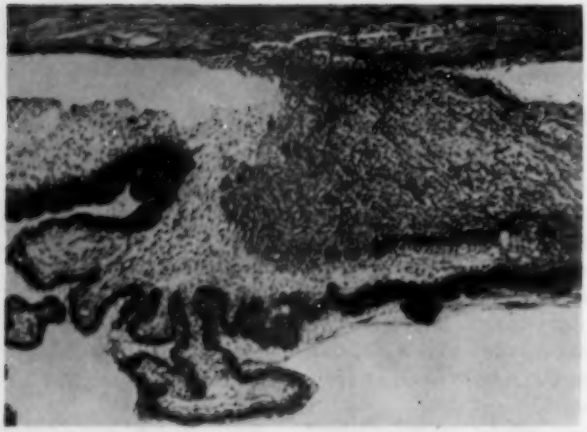

Fig. 12 (Otto Barkan). A case of acute glaucoma in a 53-year-old woman, compensated by miotics seven days previously. Note hypermetropic structure of the ciliary body. The position of the circular muscle fibers shows that the tissue between pectinate ligament [trabeculum] and root of the iris represents the pulled out, partial synechia of the root of the iris. As a result, the angle of the chamber is cleft shaped.

of the ciliary muscle (as for instance, figs. 10 and 11). The inner layers of the ciliary body also follow this pull. This can be recognized from the fact that the circular bundles of the ciliary muscle are pulled and stretched anteriorly, the most anterior bundles having been shifted laterally across the rounded off inner anterior edge of the ciliary body. Thus, in a case of acute glaucoma (figs. 10 and 12) in which the manifestations were almost eliminated by the use of miotics, the circular fibers of the ciliary muscle are still pulled to the anterior surface of the ciliary body, although the synechia of the root of the iris is freed through therapy after it has existed for a long period of time, there still remains a quite abnormal configuration of the base of the iris (fig. 13). Thus although the pectinate ligament [trabeculum] has become free, the stroma of the root of the iris remains adherent to the anterior surface of the ciliary body and arises from this surface directly at the pectinate ligament. As a rule, there is quite a wide space between the anterior ciliary processes and the posterior surface of the iris (figs. 10 and 11). Only very rarely do the most anterior ciliary processes approach the posterior surface of the iris as closely as in the normal hypermetropic or senile eye (fig. 12).

A similar position of parts can be seen in the anatomic sections of an early case of acute glaucoma published by Friedenwald[41] although his explanation of this positional anomaly (like that of Weber and others) is that the swollen ciliary processes push the root of the iris forward. Weber[40] explained the moving forward of the iris through a swelling of the ciliary body as a result of congestion and this swelling was also considered significant as a contributing factor in the formation of the glaucomatous synechia of the root of the iris by other authors. Priestly Smith[19] made the increase in volume of the lens responsible for the forward movement of the iris. Many others tried to explain the forward movement of the lens by an increase in volume of the vitreous.

According to Elschnig, all these factors can lead only to an approximation or apposition of the iris to the posterior surface of

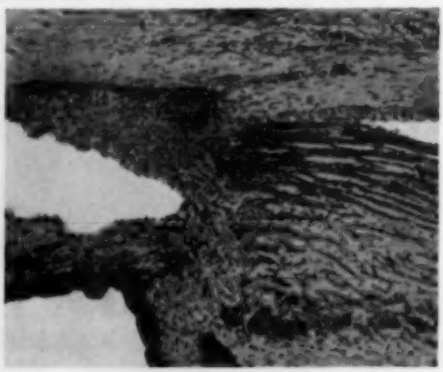

Fig. 13 (Otto Barkan). A case of acute glaucoma in a 67-year-old woman operated upon by sclerotomy, followed by iridectomy and eventual enucleation eight years later. The synechia of the root is only partially loosened; the iris still arises from the anterior surface of the ciliary body which is of the hypermetropic type. The iris and remaining areas of the pectinate ligament [trabeculum] are densely infiltrated by lymphocytes. The veins of Schlemm's plexus are completely obliterated in this region with copious lymphocytic infiltration.

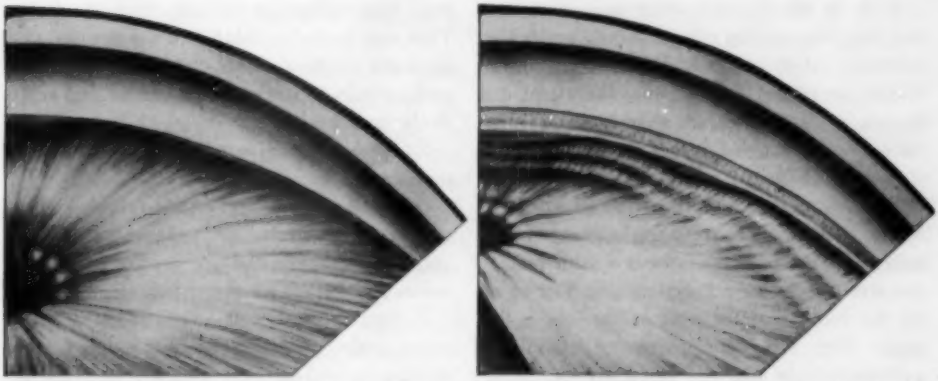

Fig. 14 (Otto Barkan). Narrow-angle glaucoma in the noncongestive phase. Gonioscopic view in the 6-o'clock meridian before and after peripheral iridectomy performed through a self-sealing incision in the 12-o'clock meridian.

the cornea but not to the peculiar lodgement of the iris in the chamber angle which is accompanied by a displacement of the most anterior ciliary processes. He indicated that this displacement is the consequence, not the cause, of the change of position of the iris. He maintained that only an increase in fluid or an increase in pressure between posterior and anterior chambers could produce the glaucomatous synechia. Czermak[42] had explained the mechanism which comes to play when the root of the iris contacts the posterior surface of the cornea, and the connection between anterior chamber and the chamber angle proper is closed off. He suggested that the aqueous is sucked out of this closed off area by the plexus of Schlemm while the pressure rises in the rest of the chamber as a result of the blocking off. Thereby, the root of the iris bulges outward like a sack and is sucked or squeezed into the chamber angle.

The increase in pressure in the posterior chamber over the anterior chamber, which had been inferred by Elschnig on the basis of anatomic observations, is confirmed by the gonioscopic, surgical, and experimental observations mentioned in the present and recent articles. These suggest that increased seclusion causes the bombé of the peripheral iris and that this latter results in the peculiar valvelike lodgment and reduplication of the root of the iris seen in anatomic sections and the displacement of the ciliary processes which is seen gonioscopically.

Effectivity of miotics in narrow-angle glaucoma

It is generally recognized that in the course of narrow-angle glaucoma it may become difficult to maintain miosis. I have been impressed by the increased effect of miotics following peripheral iridectomy. For example, in one patient who had clinically noncongestive narrow-angle glaucoma, prostigmine (five percent) given every two hours preoperatively was insufficient to reduce tension below 28 mm. Hg (Schiøtz) and to produce miosis of less than two mm. Following peripheral iridectomy, prostigmine (one-eighth percent) three times a day sufficed to achieve a miosis of less than one mm. and to reduce the tension to 18 mm. Hg (Schiøtz). This has continued to be the case several years after operation.

In another case, pilocarpine (two percent) reduced the tension to 29 mm. Hg (Schiøtz). After peripheral iridectomy, the tension was reduced to 16 mm. Hg without drops. The previous miotic proved intolerable because of pain. However, pilocarpine (0.5 percent) was tolerated with comfort.

Both of these cases were noncongestive and the preoperative tension, while under the influence of miotics, had been only moderately increased. There was, therefore, no reason to suppose that absorption of the miotic was retarded by more than a very slight extent by the increased pressure.

It is suggested that the reduced effectivity of miotics in narrow-angle glaucoma is caused by the bombé of the iris with resultant stretching of the radial muscle fibers and by the folding of the root of the iris in the angle (fig. 10). The increased effectivity postoperatively appears to be the result of the relief of the bombé and of the unfolding of the root of the iris in the angle.

One would also expect the ciliary muscle, as a result of its changed position, to be handicapped in its action of unfolding the trabeculum and pulling on the scleral spur.[43,44] Any correction of its abnormal position by iridectomy would increase its effectivity in increasing outflow.

It is conceded that other factors may be involved in the increased effectivity of miotics following peripheral iridectomy but it is suggested that this explanation of their increased effectiveness fits remarkably well into the theory of the pathogenesis of the narrow-angle iris-block mechanism given in the foregoing.

Summary

1. In all emmetropic and hypermetropic nonglaucomatous eyes in which the axial depth of the anterior chamber was average or slightly shallow, some iris bombé was present, indicating the presence of a pupillary block (functional seclusion of the pupil).

2. In myopic eyes and in eyes in which the axial depth of the anterior chamber was greater than average, there was no iris bombé and, therefore, no pupillary block.

3. Iris furrows and iridodonesis are inversely related to the amount of bombé and to the difference in pressure in front of and behind the iris.

4. Pupillary block and bombé of the iris were less marked in children than in adults. This was probably related to the greater axial depth of the anterior chamber in children and perhaps to a larger size cornea and relatively smaller lens.

5. Increase in size of the lens with age predisposes to pupillary block.

6. The incidence and causal factors of pupillary block under physiologic conditions and in primary and in certain cases of secondary glaucoma are noted.

7. In narrow-angle (iris-block) glaucoma, iridectomy performed through a self-sealing corneal incision or with an adequately sealed incision ab externo collapses the bombé and widens the angle throughout its circumference, provided the angle has not been previously closed by adhesions.

8. In some cases of narrow-angle glaucoma gonioscopy showed a "secondary" trabecular pigment band and sclerosis of the trabeculum, the result of previous contact between angle wall and the root of the iris. Tonography indicated reduced permeability of the trabeculo-Schlemm's canal mechanism in the presence of an open angle. This explained the incomplete action of iridectomy in these cases.

9. In some cases (20 percent) of noncongestive narrow-angle glaucoma, the axial depth of the anterior chamber and the corneal diameter are average and the bombé is not increased. The angle closes as the result of the last fold of the iris contacting the angle wall. These cases also react favorably to iridectomy performed with a sealed incision.

10. A progressive shallowing of the axial depth of the anterior chamber was measured during the course of noncongestive narrow-angle glaucoma.

11. A measurable deepening of the axial depth of the anterior chamber followed iridectomy in many cases.

12. Anterior position of the lens causes increased seclusion (pupillary block).

13. Conversely, pupillary block causes anterior position of the lens. Thus there is a reciprocal relationship between pupillary

block and position of the lens (that is, a vicious circle).

14. Pupillary block is probably the main factor in the local pathogenesis of narrow-angle (iris-block) glaucoma.

15. A theory is advanced to explain the chain of events in the narrow-angle mechanism, the pupillary block (increased seclusion), the increasing anterior displacement of the lens, and the retroplacement of the lens following iridectomy.

It is proposed that the most likely explanation of the anteroposterior changes in position of the lens is retention of fluid behind the lens (that is, in the vitreous compartment). It is assumed that under physiologic conditions a constant relationship is maintained between the pressures in the posterior chamber and in the vitreous compartment. If this is true then a pupillary block, by increasing the pressure in the posterior chamber, would result in increased pressure in the vitreous compartment. The latter would then be greater than that in the anterior chamber and would push the lens-zonule diaphragm forward. Iridectomy by equalizing the pressures in the posterior and anterior chambers, would equalize the pressures between the vitreous compartment and the anterior chamber, thus reversing the process and deepening the anterior chamber.

Clinical evidence suggests that changes in pressure in the posterior chamber are linked to and control corresponding changes in the vitreous compartment. A common control of the formation of fluid both anterior and posterior to the zonule may also be postulated to explain how the pressures in posterior chamber and vitreous compartment are linked. This link may in part be reflex in nature. These explanations are compatible with expansion of the vitreous compartment by increased fluid content as the cause of the anterior displacement of the lens in narrow-angle glaucoma and its reversibility by peripheral iridectomy.

Since the events described above occur only in narrow-angle glaucoma and never in open-angle glaucoma, increased seclusion (pupillary block) and closure of the angle, which are present in one and not in the other, appear to be the "trigger mechanism" which initiates the chain of events.

It is suggested that another factor may be that the pupillary block and iris bombé, by exerting a forward and outward pull, rotate the ciliary body on its axis. As a result, the insertion of the zonule advances, permitting an anterior displacement of the lens. This would also increase the pupillary block.

16. The effectivity of miotics in narrow-angle glaucoma is increased following peripheral iridectomy. An explanation is offered for their increased effectiveness on the basis of the theory of the pathogenesis of the narrow-angle (iris-block) mechanism which has been presented.

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I am grateful to Julius Springer, Publishers, Berlin, for permission to reprint the figures and legends (figs. 10 through 13) of A. Elschnig which appeared originally in *Handbuch der Speziellen Pathologischen Anatomie und Histologie*, 1928.

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VOLUNTARY LUXATION OF THE GLOBES*

Report of a case

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Although the literature contains several reports pertaining to the forward luxation of the eyeballs, not all of them can really be classified as such. Luxation can be defined as protrusion of the eye between the eyelids with a spastic closure of the lids behind the eye. Such cases can be categorized as (a) voluntary, (b) self-induced, and (c) traumatic. This report will consider only the voluntary type of globe luxation and, together with a review of the literature, will present an additional case not previously reported.

Occasionally, proptosis of the involuntary type occurs. These protrusions should not be considered as true voluntary luxations. The involuntary type is exemplified by two cases which recently were encountered in private practice.

One patient had a proptosis of the globe when the upper eyelid of the left eye was raised. The eye became luxated and was returned to the orbit with some difficulty after cocainizing the globe and allowing the patient to relax the orbicularis.

The second case was that of a young mother who had an exophthalmos on a thyroid basis. During a period of fright when she thought her youngster was falling from a basinette, she reached for him in terror and her eye proptosed. It remained forward for some time and she was advised by telephone to put some warm water in her hand and apply gentle pressure on the globe. The eye returned to its normal position under this treatment. Subsequently, the patient had bilateral tarsorrhaphies to prevent recurrent luxations.

Mertens[1] described the first case of what was considered a true voluntary luxation in a 38-year-old Negress. The patient's ability to luxate her globes was first discovered when her lids were retracted during an examination.

Ferrer[2] reported a case of voluntary luxation in a 20-year-old Cuban half-breed who was somewhat mentally defective. The patient was able to proptose one or the other eye or both at will. Visual acuity in the right eye was 20/40 and in the left eye was 20/30. Visual fields were normal. An alternating divergent strabismus of 20 degrees was present. Visual acuity was not diminished when the eyes were proptosed. Ocular rotation was limited.

J. Allen Smith,[3] in 1932, reported a case involving an 11-year-old Negro with a visual acuity of 20/30 in both eyes. His visual fields were normal and his motility good. At near the muscle findings were normal and at far an exophoria of three prism diopters was found. Accommodation was normal. The funduscopic examination was normal except for diminution in the size of the retinal arteries. The tension was normal in both eyes. Although the patient first experienced diplopia upon voluntary luxation, he was able to overcome this later and maintain the luxation for several minutes without any effect on the visual acuity.

In 1936, Lyle and McGavic[4] reported the case of a Negro who made his living by proptosing his right eye at will. An autopsy revealed the presence of an anomalous superior oblique muscle which was bifurcated just after passing through the trochlea so that the upper branch joined the superior rectus 10 mm. behind its normal insertion, while the lower branch achieved a normal attachment to the globe. Although all the other

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Fig. 1 (Ruedemann, Roberts, and Seligson). Voluntary luxation of the globes, front view.

muscles were normal in every respect, an extra, well-developed oblique muscle, 42 mm. long, was found in the lower orbit, originating just behind the orbital tubercle. This muscle inserted in an area eight mm. wide in the posterior part of the globe.

Report of a case

A new case of luxation of the globes was recently seen at Detroit Receiving Hospital. The patient, M. M., a 49-year-old Negro, has possessed the ability to luxate his globes since childhood. This phenomenon was especially apparent on coughing or sneezing. Spontaneous luxation even occurred during sleep. The patient's parents and half-brother have prominent eyes but they do not have the ability to protrude their eyes.

Ophthalmologic examination revealed a visual acuity of: O.D., 20/400; O.S., 20/200. With correction this could be brought down to 20/20, O.U. His visual correction was: O.D., −4.5D. sph. ⊃ +3.5D. cyl. ax. 50°; O.S., −5.5D. sph. ⊃ +5.25D. cyl. ax. 110°.

The palpebral fissures measured 10 mm. in width, O.U. From canthus to canthus they measured 40 mm., O.U. The Hertel exophthalmometer reading with the instrument set at 121 mm. revealed a reading of 25 mm., O.U. On luxation of the globes the exophthalmometer reading was 31 mm. with the instrument set at 120 mm.

The upper lid was 4.5 mm. below the limbus, while the lower lid was 2.0 mm. below the limbus, O.U. Prostigmine and cocaine had no effect upon the lids.

A muscle examination revealed orthophoria for near without correction. At distance without correction there was an esophoria of 10 prism diopters. With correction there was orthophoria for near and an esophoria of 14 prism diopters for distance. Motility was good in all directions. The near point of convergence measured 125 mm.

On gross examination the lids, lacrimal apparatus, conjunctiva, cornea, and anterior chamber revealed no abnormalities. Slitlamp examination was essentially negative. The pupils reacted to direct and consensual light. They also reacted to accommodation. Adrenalin and cocaine had no effect upon the pupil.

Funduscopic examination revealed discs which were normal in size, shape, and position. The color was good. There was a small physiologic cup, O.U.

The right eye revealed moderate sclerosis of the vessels. The vessel ratio was 3 to 1. There was slight arteriovenous nicking, tortuosity, and an increased light reflex. A linear white exudate was present superiorly in the macular area.

The left eye revealed sheathing, tortuosity, and an increased light reflex. The foveolar reflex could not be elicited, O.S. Temporal crescents were present, O.U. The media were clear in both eyes. On luxation of the globes the veins became markedly dilated and ar-

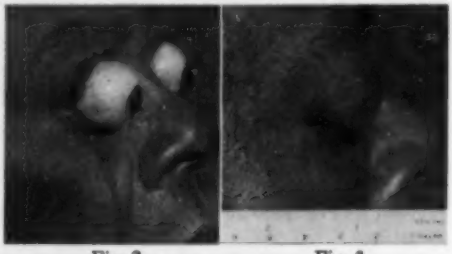

Fig. 2 Fig. 3

Figs. 2 and 3 (Ruedemann, Roberts, and Seligson). (Fig. 2) Voluntary luxation of the globes, side view. (Fig. 3). Hertel exophthalmometer reading, 25 mm., O.U.

teriovenous nicking increased perceptibly.

The patient could luxate either eye singly or together at will. The left eye luxated more readily than the right. At times there was a slight difficulty in luxation and all that was necessary was the mechanical lifting of the eyelids. There was no pain during this procedure except for the annoying sensation of drying of the cornea. This sensation could be alleviated by the instillation of 0.5-percent pontocaine in the conjunctival sacs.

Whenever the orbicularis muscles clamped down behind the globe during luxation, the patient had a tendency to become panicky. Upon relaxation of these muscles the patient always returned the globes to their normal positions. With the aid of pontocaine the patient was able to maintain protrusion for two to three minutes.

The patient displayed limited motility in all directions while the eyes were out. The visual acuity was reduced to light perception and projection.

X-ray studies revealed both orbits to be normal in size and configuration. The eyeballs were equal in size. The optic foramina measured six to seven mm.

Electro-encephalogram recordings revealed no abnormalities. The tracings revealed the patient to be in a state of greater alertness when the eyes were luxated. A basal metabolism rate and a pneumo-encephalogram could not be done at the time of this report because of the physical status of the patient. The patient's Wassermann was negative and his total serum cholesterol was 211 mg. percent. Field examinations were essentially negative.

A summary of the general medical findings and the initial reasons for admission to the hospital revealed a history of ankle edema for a period of two years. The patient's chief complaints were shortness of breath and a history of fatigue. The patient was an attendant at a night club and said he ate rich foods and drank considerable amounts of water.

Physical examination revealed a large Negro who was not acutely ill, who was cooperative, intelligent, and had a very pleasant disposition. He weighed 305 lb. and had a blood pressure of 224/150 mm. Hg. The heart revealed a tachycardia. There was swelling of the scrotum and legs. The edema of the legs was four plus.

The medical diagnosis was essential hypertension with right-sided heart failure.

Under digitalization and general cardiac therapy, he lost 50 lb. and his edema began to subside. At the time of this printing the patient was ambulatory and still under treatment.

Discussion

Of marked interest is the mechanism of spontaneous luxation of the globes. There have been various explanations and almost every individual who has reported a case has had his favorite method of explaining the phenomenon.

Ferrer thought that the eyeball was luxated by contraction of the oblique muscles and relaxation of the recti and that luxation was maintained by contraction of the orbicularis.

A. Almeida[6] did not believe in Ferrer's theory but instead thought that the orbits were shallow and that the ligaments were relaxed. However, in any explanation three factors must be considered. (1) The smooth muscles of the eye, (2) the extrinsic ocular muscles, and (3) muscular anomalies.

The smooth muscle of the orbit as a means of protrusion has been ruled out on a basis of its rudimentary character. Mueller's muscle in man is poorly developed and has no effect upon the movements of the eye. Landstrom's muscle, which is periorbital and thought to play a part in exophthalmos, is involuntary and its functional value is dubious.

The case for the extrinsic ocular muscles and muscular anomalies is much stronger. In the former, the recti can be regarded as retractors and the obliques can be regarded as protractors. Theobald thinks that this is the means of maintaining the equilibrium of the

globe. If this retractor-protractor balance is in any way upset so that the protractor element is increased, voluntary luxation of the globe can result.

For this reason it is possible that Ferrer's explanation is feasible, and the mechanism of the luxation by means of an extra oblique muscle is certainly apparent in Lyle and McGavic's case. The means of luxation in the case now being reported is unknown.

Summary

A new case of voluntary luxation of the globes was presented together with a review of the literature. Fundus findings were in keeping with a medical diagnosis of essential hypertension. That this individual was a Negro seemed to substantiate the fact that this condition is more prone to occur in the colored race. Mentality apparently is in no way connected with this condition. In contradistinction to Ferrer's case this patient had a decrease in visual acuity on luxation. In spite of a detailed work-up no explanation could be furnished for the mechanism of voluntary luxation of the globe.

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MANDIBULOFACIAL DYSOSTOSIS ASSOCIATED WITH DERMOLIPOMA OF THE CONJUNCTIVA

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Two cases of mandibulofacial dysostosis are presented because of the presence of symmetrical dermolipoma of the eyes, which has not hitherto been reported in this syndrome.

The first case was seen one year ago in the eye clinic of the Zaneion Hospital, Piraeus, Greece. The second case is that of a patient of the Northwestern University Medical School.

It is only recently that much interest has been shown in mandibulofacial dysostosis. One case was reported by Berry (1880), another by Collins (1900). Later on van Lint, Hennebert, and Mann admitted that it is a special type of malformation but they did not specify the type. Franceschetti (1944) first distinguished these deformities from others and inspired the thesis of his pupil, Zwahlen. The two authors collected the recorded cases, described the type of the abnormalities, and named them mandibulofacial dysostosis or Franceschetti's syndrome.

The syndrome is characterized by malformations of the lids, the facial bones, and the ear. Franceschetti and Klein described the predominant characteristics of the disease as:

1. Obliquity of the palpebral aperture laterally and downward (antimongoloid type), accompanied by colobomas and sometimes by abnormal growth of the eyelashes.

2. Hypoplasia of the facial bones especially of the malar bone, the maxilla, and the mandible.

3. Abnormalities of the external, the middle, and the internal ear.

4. Large mouth (macrostomia), high palate, abnormal growth, and malocclusion of the teeth.

5. Blind fistulas between the mouth and the corresponding ear, along a figurative line from the corner of the mouth to the ear.

6. Abnormal growth of hair on the cheeks.

7. Possible combination of other abnormalities of the face and the skeleton.

As these characteristics show, the abnormalities involve especially the lower part of the skull, but Bregeat and Naud state that there is no sharp division. We can find such coexisting abnormalities of the cranial bones as exaggerated convolutional markings of the skull vault and malformations of the sella turcica.

The disease does not appear as a full syndrome as a rule. All of the abnormalities may not be present. Franceschetti and Klein describe the following forms:

1. *Full syndrome.* As has been described.

2. *Imperfect type.* The antimongoloid shape of the lids and the hypoplasia of the mandible and the malar bone do exist, but the auricles of the ear are normal.

3. *Abortive form.* Here are observed only malformations of the lids, the antimongoloid type of the palpebral aperture, and colobomas of the lids. Included here also are those cases in which the malformations are so slight that one cannot say whether they are malformations or physiologic variations.

4. *Unilateral form.* When the abnormalities involve only one side of the face.

5. *The atypical form.* One of the principal characteristics is missing, in its place another malformation, such as microphthalmos, which does not belong to Franceschetti's syndrome, may be present.

Mandibulofacial dysostosis is hereditary. Berry observed it in a mother and daughter; Debusman in nine persons of the same family in three generations; Mahoney and Price found a grandfather, mother, and daughter showing these abnormalities; Brohn and Kluska, a grandmother, father, and son; Venero Roselli, two sisters.

The hereditary type is irregularly dominant. The affection is attributed to an inhibition of the development of the first and second branchial arches and clefts at the seven-to-nine-week period of intrauterine life. The determinant cause is unknown. Duyse thought that colobomas were due to amniotic bands, but had no definite proof. It is more probable that the affection is due to a defect in the gene.

It is remarked that the members of a family who have the mandibulofacial dysostosis may show other defects of the body such as deafness, fragilitas ossium, syndactyly, or abnormalities of the skeleton.

Mandibulofacial dysostosis is related to craniofacial dysostosis and the otocephaly. In the field of experimental embryology, Wolf, by means of radiation, succeeded in producing malformations in chickens, some of which resemble mandibulofacial dysostosis.

Case reports

Case 1

One year ago a young white woman, aged 21 years, asked for removal of two symmetrical bilateral tumors of her eyes. The deformity of this girl was striking. The entire face was asymmetric. The right part of it was hypoplastic and the right corner of the very large mouth was pulled to the corre-

Fig. 1 (Tranos). *Case 1.* Asymmetric form of Franceschetti's syndrome.

Fig. 2 (Tranos). Symmetrical lipodermoid tumor of the conjunctiva.

Fig. 3 (Tranos). Cartilage formation replacing the auricle. The impression on the cheek is not a scar but a congenital malformation.

sponding ear (fig. 1). The chin was small and retrogressive. Two lipodermoid tumors of the conjunctiva at the outer canthus caused the protrusion of the lids (fig. 2).

The systemic examination showed the following characteristics.

Scalp. Normal hair growing low on the narrow forehead. The eyebrows were normal.

Eyes. Slight antimongoloid shape of the palpebral fissures. Symmetrical tumors of the conjunctiva at the outer canthus of the eyes (left tumor larger than the right one). The tumors had a white yellow color, a soft consistency, and formed two thick folds which covered the eyeball up to three mm. from the limbus. The movements of the eyeballs were not disturbed by the tumors.

Turning the eyes to the left revealed that a slight part of the left cornea was covered by the tumor. Between the tumor and the eyeball, there was a narrow cavity about one mm. in depth.

Fine hairs which could be seen by the naked eye were on the surface of the tumors which, clinically, appeared to be dermolipomas.

The pathologic examination performed by Dr. Eleftheriou showed:

The tumor biopsy consisted of fatty lobular tissue. The lobules were formed by relatively large cells separated into groups by angiomatous connective tissue. The tumor was covered by stratified pavement epithelium. Beneath it was collagenous tissue which in some places showed evidence of lymphocytic inflammatory infiltration.

Lids. The upper lids were normal. In the nasal part of the right lower lid and near the lacrimal point a small excrescence about one mm. in size was found. No colobomas of the lids were present.

Eyeballs. Anterior segment and fundus normal. Vision was 10/10 O.U.

Ears. Right ear—instead of a normal auricle there was cartilaginous formation, 3.5 cm. in length and 3.0 cm. in width, covered with skin (fig. 3). There was an imperforation of the external meatus acusticus. Behind this cartilaginous formation two small blind fistulas one mm. deep were found. Two similar cartilaginous formations were present under the skin of the cheek. They were visible as low elevations. The hearing was very poor in this ear.

Left ear—in front of a normal auricle (fig. 4), there was a small growth (Ohrhang). The hearing of the left ear was good.

Nose. The nose showed no malformation. The sense of smell was good.

Cheeks. The left cheek was normal; the right one was atrophic.

Fig. 4 (Tranos). Cartilaginous growth in front of the left ear.

In the middle of the right cheek, a horizontal depression was seen, which was directed from the corner of the mouth to the corresponding ear. The skin in this part of the cheek was thin and adherent to the underlying tissues. The depression, resembling a scar, corresponded to the line upon which fistulas may be found. Our case did not present any of them.

The fatty ball of Bichat and the muscles of the face were hypoplastic, especially the masseter, the insertion of which, in a small part of the angulus mandibulae, was very thin. The collum was atrophic. When the patient opened her mouth there was a slight deviation of the chin to the right (fig. 5).

Mouth. Unilateral macrostomia. The right part of the aperture is 10 mm. larger than the left one (fig. 1). There was a high palate

Fig. 5 (Tranos). Asymmetric large mouth, with slight deviation of the chin.

Fig. 6 (Tranos). Atrophy of the ramus mandibulae of the right mandible. Aplasia of the condyloid and coronoid processes.

and malocclusion of the teeth. The chin was hypoplastic and retrognathic.

X-ray studies. The ramus mandibulae of the right mandible was atrophic, the condiloideus and coronoideus processes were aplastic (fig. 6). There was hypoplasia of the malar bone. The right orbit was slightly smaller than the left one. A supernumerary lumbar vertebra compensated for one missing sacral.

The patient stated that she was the only person in the family who presented these abnormalities. Her father and mother, three sisters, and one brother were normal.

Case 2

Herbert K., a white boy, aged three years, (fig. 7) presented a typical Franceschetti's syndrome with coloboma of the right upper lid and the right ala of the nose, bilateral dermolipomas of the conjunctiva and a dermoid tumor of the limbus in the right eye.

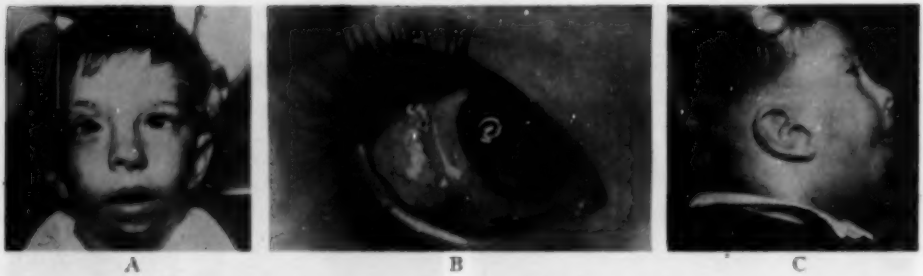
Scalp. Normal hair.

Eyebrows. Normal.

Eyes. Antimongoloid shape of the palpebral fissure, bilateral subconjunctival dermalipomas of the outer canthus (fig. 7A).

Lids. Right eye—coloboma of the upper lid (fig. 7B). The lower part of the cornea remained uncovered when the eyes were closed. The lower lid was normal. The left eye had normal lids.

Eyeballs. Normal size. On the limbus of the right eye at the 7-o'clock meridian was



A B C

Fig. 7 (Tranos). Case 2. Franceschetti's syndrome. (A) Oblique direction of the ears, coloboma of the right upper lid and the right ala of the nose. (B) Dermolipoma of the conjunctiva, dermoid tumor of the cornea. (C) Fishlike profile.

a round dermoid tumor about one mm. in diameter. Close to this tumor was an area of exposure keratitis due to the lid coloboma.

Fundus findings were normal.

Ears. Pulled slightly onto the cheek. In front of the left ear was a growth which was later removed.

Nose. Coloboma of the right ala of the nose.

Chin. Hypoplastic, large mouth, and fishlike profile (fig. 7C).

The parents of this patient, of German origin, were both from the same village. They had the same name but did not know if they were related. There is no other person in the family showing congenital malformations.

Summary

The malformations in the first case are predominantly on the right side of the face. On the left side only the dermolipoma and the antimongoloid shape of the lid aperture were present. It is, therefore, an asymmetric form. The second case shows a typical bilateral Franceschetti syndrome.

The malformations of the ear are more marked in the first case. Ranke describes three degrees of this kind of deformity which he calls "ear on the cheek" (Wangenohr Melotus)[1]:

First degree. The ear is directed down and forward (clownface).

Second degree. The auricle is separated in lobules.

Third degree. The dispersion of the lobules representing the auricle is greater and accompanied by a pseudoear on the cheek.

The first case presents a second-degree malformation of the ear on the right side of the face only. The second case has a first-degree deviation of both ears. The scarlike impression of the cheek can be explained as a result of a faulty embryologic fusion between a maxillary process and the primitive frontal process.

The fusion of the facial components, as well as a similar union elsewhere in the developing embryo, takes place in the same manner as the healing of simple wounds.[2] In a general way, the malformations of mandibulofacial dysostosis are attributed to the arrest in development of the first and second branchial arches and of the first branchial cleft. The causes of this arrest are unknown.

The combination of the antimongoloid shape of the lid aperture and the colobomas of the lids give to the Franceschetti syndrome a particular character which separates this type of malformation from otocephaly. The presence of dermolipomas in both of our patients adds another symptom which can be found in some cases.

The dermoids and dermolipomas must be attributed to a defect in the development of

I wish to express my gratitude to Dr. Cosmetatos, Dr. Jannovitch, Dr. Xanthakis, and Dr. Mandras.

the lids and the adnexa. The dermoid represents an island of epidermal tissue on the cornea.[3] It is supposed that both dermoids and dermolipomas arise from congenital arrest of the primitive ectoderm.

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THE CRANIOSTENOSES

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Blindness because of increased intracranial pressure or because of kinking or stretching of the optic nerve due to premature synostosis of the cranial sutures has commanded the interest of ophthalmologists and neurosurgeons alike for the past half century or more.

In a high percentage of cases dangerous sequelae follow premature synostosis. In addition to affections of the optic nerve, there may be deforming changes in the skull, causing compression of the brain and producing headache, epileptiform seizures, and diminution of mental capacity.

Deformation of the orbit produces exophthalmos, divergent strabismus, exposure keratitis, and, in extreme cases, evulsion of the globe. Structural variations in the superior maxillae produce grotesque facial changes with irregularities of the palatine vault, uneven teeth, malocclusion, and relative prognathism.

Craniofacial distortions result from a multitude of causes; among them are trauma, syphilis, tuberculosis, rickets, acromegaly, hydrocephalus, microcephalus, macrocephalus, gargoylism, leontiases ossea, achondroplasia,[53] cranioschisis, delayed synostosis, and premature synostosis. This discussion considers only the last named, the craniostenoses or premature synostoses.

Early writers occasionally confused craniostenosis with syphilis, rickets, and even with exophthalmic goiter. Modern laboratory methods eliminate such errors. Achondroplasia and cranioschisis, in that they represent embryologic disorders which are due to mesodermal failure, might be confused but for modern roentgenologic techniques, which can readily demonstrate prematurely synostosed sutures. Microcephaly could be most confusing; however, the condition being due to failure of the brain to enlarge, digital markings of the skull are diminished and no synostotic sutures can be found.

The general deformities of the skulls and the grotesque faces of many of these patients might lead one to consider the necessity of differentiating them from gargoylism or Hurler's disease.[12, 18, 19] The absence of other tissue changes in the liver, heart, spleen, and corneas, and as recently shown in the scleras,[66] places gargoylism in an entirely different group from the craniofacial dysostoses in which other tissues are not involved except as may occur from increased intracranial pressure and its resultant bony deformity, or from associated embryologic failure.

Virchow's[91] studies of cranial deformities, in 1851, are freely cited by authors interested in such abnormalities, to the extent that one of his assumptions came to be known as Virchow's law. Freely translated Virchow's postulation states that limitation of expansion in directions perpendicular to the line

Fig. 1 (Howell). Crouzon's original cases, both showing cranial and facial deformities. (From *Bulletins et mémoires de la Société médicale des hôpiteaux de Paris*, **33**:545-555, 1912.)

of the prematurely closed suture causes overexpansion to take place in the regions where the sutures remain open.

Thus, premature synostosis of the sagittal suture produces excessive widening of the coronal and lambdoid sutures, a scaphocephalic skull being the result. Premature synostosis of the coronal or lambdoid suture results in widening of the sagittal suture and the production of a brachycephalic skull, greater occipital widening occurring when the coronal suture is first synostosed and greater frontal widening being the result of earliest synostosis of the lambdoid suture. Early synostosis of all sutures may cause the whole skull vault to be raised in oxycephaly.

As early as 1866, von Graefe[28] recognized the association of optic atrophy with cranial deformities; similar observations later were made by Michel,[47] in 1873, and by von Hirschberg, in 1883.[24]

In 1897, Marie and Sainton[45] described a father and son with a condition characterized by wide heads, facial deformity with shallow maxillae, and relative prognathism associated with aplasia of the clavicles. To the condition they gave the name of "dysostose cleidocranienne héréditaire" or hereditary cleido-cranial dysostosis. These authors had been preceded some 10 years by Parham's report of a case of syndactyly of all four extremities associated with bony deformity of the face. Parham,[51] however, did not attempt to give a name to the condition seen in his case.

In 1906, Apert[2] presented a patient having craniofacial deformities associated with syndactyly of both upper and lower extremities. In this report he reviewed other reported cases and proposed for the condition the name of acrocephalosyndactyly. In many subsequent discussions he continued to champion the designation of a group of symptoms showing craniofacial deformities associated with changes in the hands and feet as acrocephalosyndactyly or dysostosis craniofacialis with syndactyly. He believed the condition to be a definite clinical entity.

→

Fig. 2 (Howell). Crouzon's family showing evidences of dysostosis craniofacialis in some, while others show no signs. (A) Mother shows moderate facial changes and divergent strabismus. Daughter and oldest boy are normal. (B and B′) Younger boy, aged five years, shows typical signs of dysostosis craniofacialis. (C and C′) Youngest boy, aged three years, shows typical signs of dysostosis craniofacialis. (From *Annales de médicine*, **25**:84-91, 1929.)

A
B
B'
C
C'

Crouzon,[14] in 1912, was destined really to kindle the flames of literary controversy on the subject. In his presentation before the Société Médical d'hôpiteaux de Paris, he described a mother and her son (fig. 1), showing cranial deformities, recession of the maxillas with relative prognathism, marked exophthalmos, divergent strabismus, and optic atrophy with diminution of vision. His description of the patients is highly picturesque; for instance, he notes that the child's nose is curved, as is the mother's, which abnormality together with the cranial deformity gives the appearance of the head of a bird. For this condition he proposed the name, dysostosis craniofacialis familial and hereditary. Though many isolated instances of dysostosis craniofacialis were reported, Crouzon's opinion that these cases were hereditary and familial continued to be accepted by most of the contemporary French writers, but observers of other nationalities were hardly so cordial.

Crouzon later presented a number of cases,[15–17, 55] some of which were isolated, some familial (fig. 2), and some atypical. To these atypical cases he applied the term "forme fruste" and showed in more than one instance that such persons might beget progeny which answered his requirements for dysostosis craniofacialis familial and hereditary. Crouzon was of the opinion that premature synostosis of the metopic suture was a major factor in the production of the "syndrome" which he championed. Indeed in some of his cases, it may have been an agent yet later observations reveal that premature closure of this suture may produce only a narrow forehead with perhaps "trigoncephaly" or triangular-shaped skull with

Fig. 3 (Howell). Patient showing craniofacial deformity and absence of right hand. Reported as Crouzon's disease, but called Apert's disease by both Crouzon and Apert. (From *Bulletins et mémoires de la Société médicale des hôpiteaux de Paris*, **56**:1458-1462, 1932.)

Fig. 4 (Howell). Patient with dysostosis craniofacialis complicated by complete evulsion of right globe. (From *Bulletins et mémoires de la Société médicale des hôpiteaux de Paris*, **58**:1178-1188, 1934.)

no further disability being apparent.

Crouzon was followed by numerous French writers[4, 7, 13, 26, 28, 42, 49–50, 84] on the subject, most of whom accepted Crouzon's ideas, though many isolated and atypical cases were reported.

As one reviews the literature, he is certain to note the tenacious, almost vicious, attitude assumed by Crouzon and Apert in defending their position in claiming that their patients represented definite syndromes which are due to specific causes.

The discomfort of Garcin, Thurel, and Rudaux[27] can hardly be imagined when they had the temerity to present before the Société Médical d'hôpiteaux de Paris a case (fig. 3) which they classified as Crouzon's disease, only to have Apert deny that it resembled Crouzon's disease at all but was a perfect example of acrocephalosyndactyly or Apert's disease. Crouzon's complete agreement with Apert did nothing to temper their embarrassment. Garcin, however, later was to make valuable contributions to the study of the disease (fig. 4).

Naturally the challenge was accepted by the German, Dutch, and Swiss observers,[20, 37, 56–57, 59–60, 62, 64] though agreement was not so complete as from the writers of his own country. Vogt, in 1933, decried the whole idea of separate names for each combination of symptoms with the statement, "that all of these conditions should be considered as Dyskephalies" or cranial dysostoses. He believed that entirely too few cases had been shown to build up a complicated nomenclature, and that all might be better designated by the prematurely synostosed suture producing the "Dyskephalie." Vogt's conception seems to be well in accord with modern opinions and in addition it complies completely with Virchow's postulations as to skull growth.

The cause of premature synostosis is not known. That it occurs in family groups and that it may be transmitted from parent to

child cannot be questioned. That it may appear sporadically in families in which it has never before appeared also is beyond doubt, that one form of premature synostosis may beget still another has been shown, that premature synostosis occurs in association with other embryologic changes which are due to mesenchymal failure has been reported in many instances.

Virchow thought that premature synostosis might be due to some form of meningitis appearing in the cranial membranes of the fetus but evidence to substantiate such belief has not been forthcoming. Crouzon chose to explain premature fusion of the cranial sutures by Mendelism. He believed that the disease was recessive and explained its rarity in this way.[1] It appears, however, that it may occur occasionally as a mutation and may breed as a dominant.

Apert considered the condition as teratologic in origin agreeing that "sports" or mutations may occur.

Mann's[11] theory offers the most plausible explanation. Her theory suggests that the whole condition is of genic origin and that it is due to mesodermal failure within the bones of the skull, producing a reversion of type toward that of the lower animals which have a narrow skull base with flattening of the anteroposterior line and divergence of the orbits. There is thus reversion to an atavistic type. Such change assumes that in addition to premature synostosis we must include "failure of interstitial growth of the bones of the base of the skull as well, since the whole architecture of this region is at fault."

If the vault of the skull expands sufficiently, while there is disease only in the base, there may be much bony deformity without great damage to the optic nerves. On the contrary, if synostosis of the sutures prevents the relief of pressure by expansion, there may be papilledema followed by consecutive atrophy. In other cases the upward slope of the distorted orbits and the downward displacement of the skull base may result in kinking of the optic nerve at its exit from the optic foramen. These are the cases of primary optic atrophy. Both types of atrophy are thus explained.

Eye findings

Ophthalmologic findings may be divided into two groups, the consistent findings and the inconsistent findings.

The *consistent findings* are shallowing of the orbits, divergence of inter-orbital angle, and divergent strabismus (actual or due to the divergent orbits) without limitation of extraocular movement. As a result of these conditions, we find proptosis, widening of the palpebral fissure, lagophthalmos, exposure keratitis, and in extreme cases complete evulsion of the globe. Later there appears papilledema followed by optic atrophy and loss of vision or there may be primary optic atrophy.

The *inconsistent eye findings* present a heterogeneous array of ophthalmic changes, none of which occur with sufficient regularity for them to be considered a part of a definite entity. Among the findings noted in the literature are:

Coloboma of the iris (Ballantyne, Ellis), irregularity in shape of the pupil (Parham, Bedell), congenital cataract (Crouzon, Legras), coloboma of the choroid, nystagmus, vitreous opacities, myelinated nerve fibers, detachment of the retina (Crouzon), and subluxation of the lens (Brockmeyer).

All of these conditions we may ascribe to mesenchymal failure. Indeed, they are often associated with similar embryologic disorders in other parts of the body, such as, syndactyly, high palatine arch, cleft palate and lip, congenital dislocation of the hip,[5] congenital aplasia of the clavicle, malformations of auditory canal,[6] and congenital deafness.

Thus it appears that the ophthalmologic findings in craniostenosis are consistently the same except for those conditions which are directly due to mesenchymal failure. The consistent findings are those of increased intracranial pressure. The inconsistent findings

are those which are due to embryologic failure.

Optic atrophy. The most important of all eye findings is optic atrophy. Theories as to its cause do not coincide. Virchow believed that premature synostosis might be the result of meningitis along the suture lines and that the atrophy followed optic neuritis, which is due also to some form of meningitis.

Medinger and Morard,[46] in 1935, offered three possible theories as to the origin of optic atrophy along with the proponents of each:

1. Cerebral hypertension (Chatelin, Allouche, Badot).
2. Compression of the optic nerve in the cramped optic canal (Monthus, Grenet, Garcin).
3. Mixed theory (Pesme).

Friedenwald[28] accepted the theory that cerebral hypertension was the cause of such optic atrophy and closed his discussion of the condition by stating . . . "that optic neuritis in these cases depends on increased intracranial pressure produced by premature synostosis and is therefore similar to that associated with tumors of the brain."

It is now believed that the optic atrophy in premature synostosis may be due to compression of the optic nerve within the flattened optic canals, or to pressure alone, or to a combination of both conditions.[65]

Attempts at classifying irregular skulls have been made by several writers though as yet there seems to be no general acceptance of any one arrangement. As early as 1851, Virchow[61] offered this classification:

1. Macroencephalic group—water head, hydrocephalics.
2. Microcephalic group—small head, dwarf head.
3. Dolichocephalics—long head.
   A. Long-headed group (synostosed sagittal suture).
   B. Leptocephaly—narrow heads (side synostosis of the frontal and parietal bones).
   C. Sphenocephaly—wedge-shaped head (synostosis of the parietal bone with elevation of the anterior fontanelle).
   D. Klinocephaly—saddle-head (synostosis of the parietal and sphenoid bones).
4. Brachycephalics—broad heads.
   A. Brachycephalic group (synostosis of the parietal bone with squamous portion of occipital bone). Thick head.
   B. Distorted brachycephaly. Distorted head. (Half-sided synostosis of parietal and frontal bones). Platycephaly—flat head (great compensation).
   C. Oxycephaly—peaked head, sugarhat head (synostosis of lambdoid suture).

In 1926, Grieg[29] classified the cranial deformities as follows:

1. "True oxycephaly which presents a general craniofacial stenosis. This is congenital and often associated with syndactylism or other deformities of the extremities.
2. Delayed oxycephaly which may appear at any time during childhood and never presents other deformities.
3. False oxycephaly which is localized synostosis, not congenital, and is often of definite origin."

Ballantyne,[8] in 1937, noted that the cranial deformities and craniofacial dysostoses were somewhat loosely grouped as hereditary craniofacial dysostoses (Crouzon's disease), oxycephaly (tower skull), turrecephaly, acrocephaly, acrocephalosyndactyly (Apert's disease), and hypertelorism. He considered the classification and nomenclature of the dysostoses as a whole far from satisfactory.

Brown and Harper[11] presented, in 1946, a semiclassification of the cranial deformi-

ties: (1) Scaphocephaly, (2) plagiocephaly, (3) trigoncephaly, (4) platycephaly, (5) craniolacunia, and (6) hypertelorism. This classification appears to follow no definite etiologic criteria, but merely presents a group of varying types of skulls resulting usually from premature synostosis.

In 1947, Simmons and Peyton[38] suggested the following classification:

A. "Complete, early premature synostosis of the cranial sutures (oxycephaly, turrecephaly, turmschadel).
   1. Oxycephaly without facial deformity.
   2. Craniofacial dysostosis of Crouzon.
   3. Acrocephalosyndactylism.
   4. Delayed oxycephaly (onset after birth).

B. Incomplete early synostosis of the cranial sutures.
   1. Scaphocephaly: premature closure of the sagittal suture.
   2. Brachycephaly: premature closure of the coronal suture or of the coronal and lambdoid sutures.
   3. Plagiocephaly: asymmetrical premature closure of the sutures.
   4. Mixed.

C. Late premature synostosis of the cranial sutures after the skull has reached or nearly reached adult size so that no deformities and no symptoms result."

Fairman and Horrax, in 1949,[22, 23] referred to Greig's classification published in 1926 as the accepted one up to that time. They then proposed their own classification which seems excellent from the surgical viewpoint but they eliminated Crouzon's disease with the statement, "We have excluded from this study the craniofacial dystosis of Crouzon, included by some authors, because it is very rare. In addition, the description of this condition given by Crouzon in 1929 is not clear enough to consider it as a form of craniostenosis." Cases of Apert's disease are not mentioned.

The Fairman and Horrax classification follows:

- Craniostenoses
  - Incomplete
    - Scaphocephaly
      - Compensated
      - Incompensated
    - Brachycephaly
      - Compensated
      - Incompensated
  - Complete
    - Oxycephaly
      - Compensated
      - Incompensated

From the viewpoint of the ophthalmologist, the division of these skulls into compensated and incompensated skulls is of immeasurable value. Surgical procedure on a compensated skull can accomplish only cosmetic effect. Such intervention, however, when done on the incompensated skull before the increased intracranial pressure has permanently damaged the optic nerves or brain tissue, may prevent these dangerous sequelae.

It would seem that the foregoing classification is sufficiently broad to cover cases of Crouzon's disease and Apert's disease. The skull forms in cases that have been designated in the literature by either of these names are not constant, but may belong in any of the three classes named in the Fairman and Horrax classification. Some are scaphocephalic, some are brachycephalic, and some are oxycephalic. The bizarre facial deformities and even the syndactylic extremities may be found in association with any of the foregoing types of skulls (fig. 5).

It would seem, therefore, that Crouzon's disease is that condition in which exaggerations of the facial deformity appear in any type of prematurely synostosed skull, particularly those in which there is embryologic change in the interstitial portion of the bones composing the base of the skull. The presence of syndactyly in Apert's disease is incidental and arises from embryologic irregularity as did the premature synostosis.

Aside from the many discomforts and disabilities to which these people are subjected during life, it appears that none has lived to the usual expectancy. Legras'[43] patient reached the age of 35 years; Joiris[34] studied a

Fig. 5 (Howell). (A and A′) Scaphocephalic skull from Roubinovitch and Crouzon. (B and B′) Brachycephalic skull from Vorisek. (From THE AMERICAN JOURNAL OF OPHTHALMOLOGY, **24**:1014-1018, 1941.) (C and C′) Oxycephalic skull from Fletcher. All have exophthalmos, divergent strabismus, optic atrophy, and facial deformities associated with entirely dissimilar skulls.

Fig. 6 (Howell). Hirschfeld and Hirsch—Mamroth's case of a man, aged 52 years. The oldest photographed patient the author was able to find in the literature. (From *Klinische Wochenschrift*, 10:167-169, 1931.)

man, aged 43 years, who showed signs of premature synostosis with all the signs of dysostosis craniofacialis. He was totally blind from optic atrophy. Hirschfeld's[38] patient had reached the age of 52 years (fig. 6); his vision, however, was minimal.

Treatment

Numerous possible types of treatment have been suggested. Some have been directed at preserving vision; others appear to have been done with the hope of alleviating mental retardation; still others have given thought to both conditions.

Among the earliest to attempt surgical intervention was Lannelongue,[41] who did a craniotomy for the relief of microcephaly in 1890. Shortly he was followed by Lane,[40] who did a cross-shaped craniotomy in his first case. The patient, a child, nine months of age, however, died in 14 hours. In his second case, he made an "H" shaped craniotomy and believed that the child was improved. Subsequent observers think that both of these patients suffered from microcephaly.

Fletcher, in 1911, presented eight cases of assorted types of "oxycephaly" and arrived at the conclusion that trephination seems a reasonable method of relieving the intracranial pressure and thus preventing optic atrophy. Küttner,[27] in 1913, discussed various types of surgical intervention, principally multiple trephination or one or more subtemporal decompressions. Bedell,[9] in 1917, reported the case of a boy, aged eight years, on whom a large subtemporal decompression was done but the patient died.

Monthus and Chennevière,[49] in 1929, discussed their own unsuccessful operation upon a boy, nine years of age, who survived the operation but showed little or no improvement in vision or mental condition. They made the very pertinent observation that therapy for a child of this age is of little value in the face of great bony changes and optic atrophy; whereas, in similar cases, if there is only beginning blindness, one might do a large craniotomy to prevent encroachment on the nerve and ensuing blindness. They also concluded that the age of eight to 10 months or perhaps one year is the optimal time for surgical treatment. Their opinion that surgery to be valuable must be done early was to be corroborated some 20 years later.

Brockmeyer,[10] in 1933, tried repeated lumbar punctures. He believed that the exophthalmos was somewhat reduced and that there was improvement in the appearance of the optic nerves and that the child's vision was improved. The patient was under observation from the age of one month to three and one-half years (fig. 7). No other instance of the use of lumbar puncture in the treatment of craniostenosis was found in this study. It is doubtful that such therapy produced beneficial results.

Medinger and Morard,[46] in 1935, noted that most writers prefer decompression by

Fig. 7 (Howell). Child whose condition was believed to have been improved by repeated lumbar puncture. (From *Klinische Monatsblatt für Augenheilkunde*, 91:626-628, 1933.)

bilateral trephination, that Chatelin and Allouche suggested tapping through the callosum, that the decompression trephination by Genet, Leveuf, and Isaac-Georges in an infant of 21 months did not relieve the pressure and that the infant collapsed and died. They concluded that Genet and Leveuf considered direct attack on the upper part of the optic canal after the technique of Hildebrand[31] to be the preferred surgical procedure.

It, therefore, seems that as late as this date there persisted the belief that narrowing of the optic canals, which had been noted in the writings of many authors, was the sole cause of the papilledema and subsequent optic atrophy.

As recently as 1937, Atkinson[5] stated, "Up to the present time the physician is powerless to arrest the condition. Craniectomy might be a remedy."

Writers in the United States and Great Britain have given little attention to the craniofacial dysostoses as such, one notable exception being the monumental work of Grieg in 1926, whose study was directed primarily at variations of skull form. Vorisek,[43] in 1941, reported two cases of craniofacial dysostosis and noted that no report of the condition in the English language had appeared prior to 1936. Lake and Kuppinger,[39] in 1950, reported three cases found in a grandfather, father, and son who showed typical signs of the disease.

Modern surgical procedures for the relief of blindness and the other consequences of craniostenosis have in recent years received considerable attention from American neurosurgeons. Studies showing that the brain doubles in weight during the first seven months of life and triples in weight in two and one-half years, thus completing 80 percent of its growth in the first three years, explain the need for early operation if blindness and the other results of prolonged increased intracranial pressure are to be avoided.

Renewed interest in craniotomy, at least in the United States, followed the report in 1927 by Faber and Towne[20, 21] of surgery done on a child just over six months of age. These surgeons were directing their work particularly toward the prevention of blindness. Their technical approach paralleled somewhat that of Lannelongue and Lane. Their patient (fig. 8), however, was not microcephalic but a child with a normal brain but a synostotic skull which produced increased intracranial pressure with resultant approaching blindness. They were rewarded with a measure of success which prompted them to advocate similar surgical treatment in all such cases.

King's morcellation procedure used by

Fig. 8 (Howell). Early craniotomy for stenosis of the sagittal and right coronal sutures. Two channels were cut in the skull parallel to the sagittal suture. (Reprinted with permission, from *American Journal of the Medical Sciences*, **173**:701-711, 1927.)

himself and by Woodall[67] seems to have produced improvement both in true and delayed oxycephaly, betterment of vision, exophthalmos and mental condition being observed despite the fact that the operation in all these cases was done after the third year of life. King, however, notes that greater salvage of vision might have been obtained had the patients received a decompression operation earlier.

The surgical technique consisted of connecting numerous burr holes in the skull with connecting lines of craniotomy to produce a mosaic morcellation of the skull permitting enlargement of the cranial vault from increased pressure within the dura. Exophthalmos appeared to improve despite the fact that no deroofing of the orbits was done and that the patients ranged in age from four to 14 years, thus being beyond the age of greatest brain growth.

Acceptance of such surgical methods was to be delayed, however, because rapid closure of the artificially produced lines of expansion reduced the degree of success in maintaining normal intracranial pressure. The young skulls which had been so treated showed very rapid closure of the surgically produced suture lines and symptoms recurred.

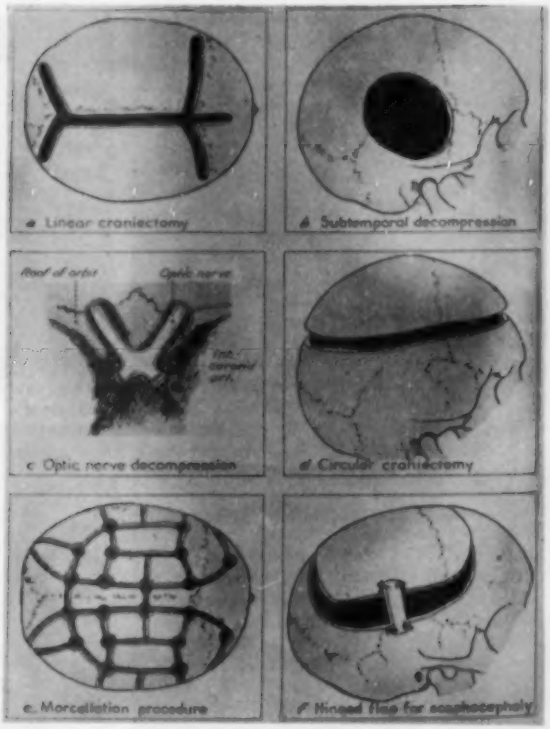
To combat this undesired rapid healing, Simmons and Peyton, in 1947,[58] advocated covering the cut edges of the skull with tantalum foil (fig. 9). In 1948, Ingraham, Alexander, and Matson[33] suggested the use of polyethylene film (fig. 10) for a similar purpose. The delayed closure of the skull so produced has greatly increased the effectiveness of surgical treatment.

Case reports

Case 1 (figs. 11-A and A')

A boy aged five years when first examined, had the history that birth had occurred after slightly more than full term. Forceps were required to complete the delivery. The mother was 43 years of age at the time of his birth and had delivered normally one male and two female children, the youngest of whom was aged 17 years when the patient was born.

The child weighed nine pounds at birth, his skull was "abnormally shaped." He had undiagnosed fever for three days following delivery; he ate poorly for



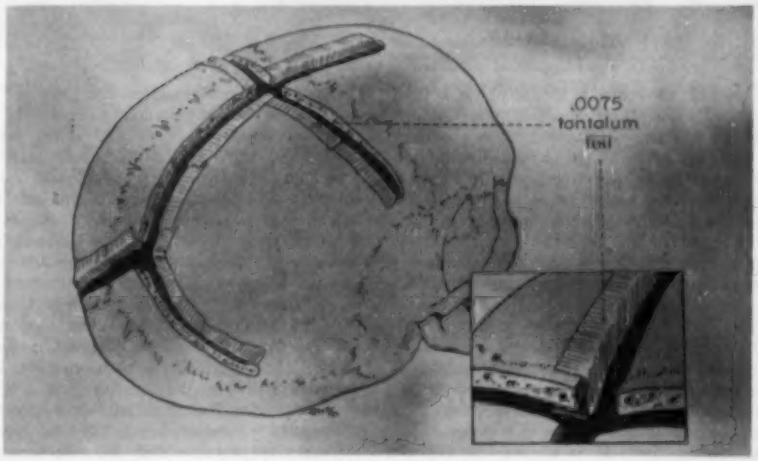


Fig. 9 (Howell). (Above) Various operations which have been used against craniostenosis. (Below) Method of covering cut edges of bone with tantalum foil. (Reprinted with permission, from the *Journal of Pediatrics*, **31**:528-547, 1947.)

Fig. 10 (Howell). Method of covering cut edges of skull with polyethylene film. (Reprinted with permission, from *Surgery*, **24**: 518-541, 1948.)

several days but soon began to thrive. His head enlarged rapidly for three months, then became stationary. At this age he was seen by a physician who told his mother that he had oxycephaly and that he might become mentally retarded. Contrary to this opinion as to his mentality, at the age of five years he seemed far more alert than the average child of his age.

Physical examination revealed a child whose body and extremities were normally developed except for partial fusion of the second and third toes on each foot. His head was grossly abnormal. All fontanelles were closed and the skull was somewhat enlarged in all dimensions. The upper jaw was underdeveloped and recessed; the gums were thicker than normal and the teeth were irregular. The receded upper jaw produced relative prognathism and malocclusion.

Ophthalmologic findings were marked. The orbits were widely spaced and the globes were divergent. When the left eye was "fixing" the right eye diverged approximately 40 degrees. There was marked proptosis and the right cornea showed scars of exposure keratitis throughout its lower half. The lids of each eye could barely be closed with effort.

Ophthalmoscopic examination revealed the right disc to be pale with smooth edges; the left disc appeared slightly pale. Visual acuity was 20/200 in the right eye and 20/40 in the left eye, with correction. Confrontation peripheral fields were roughly full and the extraocular movements showed full excursion, but there was no ability to converge the eyes.

X-ray examination of his head showed complete absence of all suture lines. The floor of the skull in its anterior portion was depressed and pushed forward so that the orbits were shortened. Both optic canals could bee seen; the left, better than the right. Both appeared to be unconstricted. Thin areas of bone marking the convolutions of the brain appeared throughout the skull.

Surgical treatment directed against the increased intracranial pressure and the excessive proptosis was decided upon. The left side of the head was attacked first. Channels along the coronal and lambdoid suture lines were opened and these were connected by an anteroposterior channel to the left of the sagittal suture. The roof of the left orbit also was removed. Seven days later a similar procedure was carried out on the right side of the skull and

Fig. 11 (Howell). PREOPERATIVE. (A and A') Case 1. Showing skull and facial changes. Exophthalmos and divergent strabismus not well shown. (B and B') Case 2. Showing skull and facial deformity, exophthalmos, and divergent strabismus. (C and C') Case 3. Showing an almost normally shaped skull, no facial deformity, moderate exophthalmos. Optic atrophy was present in the right eye, papilledema in the left eye. All sutures were closed. Note general apathetic attitude.

the roof of the right orbit.

Five days after the second procedure, there was a large accumulation of fluid under the scalp, and the left eye was completely evulsed in front of the lids. Replacing the left eye and suturing of the lids of both eyes was required. The lid sutures held for 16 days during which time the inflammatory swelling receded, and it was possible for the patient to close his eyes with effort.

Considerable damage from exposure had occurred to the left cornea and the patient now "fixed" with the right eye. Two months later clearing of the left cornea occurred and the patient again preferred to use the left eye. He was able to close both eyes completely and no increase in the optic atrophy could be detected.

Eleven months after the second operation (figs. 12-A and A') the patient was alert and active. There was no noticeable change in the exophthalmos and the optic atrophy had not increased. He continued to prefer to use his left eye despite the fact that its vision had been diminished by exposure keratitis at the time of postoperative evulsion. I believe that but for the misfortune producing the keratitis his condition would have been greatly improved.

CASE 2 (figs. 11-B and B')

The first and only child of parents, who appeared to be entirely normal, was a boy aged seven months when first examined. His head was of unusual shape and his eyes protruded when he was born. His parents sought advice because of these conditions.

Physical examination revealed a male child who was entirely normal except for abnormalities of his head. Though his head was wide in its interparietal diameter there was marked protrusion of the bregma giving the appearance of an enlongated skull. His eyes were widely spaced, and there was marked

Fig. 12 (Howell). Postoperative. (A and A') Case 1. Left eye shows some keratitis from exposure following postoperative evulsion. (B and B') Case 2. Shows some widening of skull following operation. Exophthalmos and facial deformity unchanged. No optic atrophy present. Vision good. Attempts to fuse. (C and C') Case 3. Showing bulge of scalp along line of craniotomy. Optic atrophy still exists in right eye. Left eye now shows partial consecutive atrophy. Note more alert appearance.

proptosis, but there was no divergent strabismus. His fundi appeared entirely normal. The upper maxillas were recessed, his nose was straight and beaklike and there was relative prognathism. His general appearance followed the lines of Crouzon's classical description, that his head was like that of a toad or a bird, the pointed nose giving somewhat the appearance of a parrot.

X-ray examination of his head showed that there was closure of the sagittal, coronal, and lambdoid sutures. The inner table of the cranial bones was thinned where the convolutions of the brain pressed against it, giving the skull a typical "beaten silver" appearance. The orbits were quite shallow and they were widely spaced. It was the opinion of the roentgenologist that generalized craniostenosis existed and that all other changes were the result of increased intracranial pressure.

Operation for the relief of intracranial pressure to prevent possible blindness and possibly to diminish the proptosis was decided upon. A craniotomy about 1.5 cm. wide was done along the coronal suture lines extending from one zygoma to the other. Recovery was uneventful. Twenty-five days later a similar craniotomy along the line of the lambdoid suture was executed with extension along the sagittal suture to join the earlier craniotomy. Recovery from the second procedure also was without unfavorable incident.

Postoperative X-ray examination eight days after the second operation showed the surgical defect in the skull, but as yet there was no essential change in its shape. The depth of the convolutional markings was unchanged. Examination of the eyes at this time showed no change in their external appearance. The fundi still appeared normal.

An examination three and one-half months after the operation showed some bulging of the scalp at

Fig. 13 (Howell). Showing my cases in group. (A and A′) Case 1. Four months after operation. (B and B′) Case 2. Seven days after operation. (C and C′) Case 3. Before operation.

the site of the craniotomy though some bony projections could be felt growing into the excised areas. The external appearance of his eyes was unchanged. He "fixed" a light simultaneously with both eyes and appeared to have normal fusion for his age which was then 10 and one-half months. His fundi appeared entirely normal.

Seven and one-half months after his second operation (figs. 12-B and B′) there was no change in the exophthalmos. The optic nerves appeared normal, some measure of fusion seemed to be present; he was able to converge his eyes when looking at objects held close to him. He had learned to walk normally for his age which was then 14 months. I believe that his condition had been improved in that optic atrophy had been prevented and mental retardation also had been checked.

A note on the chart by the neurosurgeon stated

that because of the great proptosis, deroofing of the orbits might later be done, but only after the intracranial pressure was under control.

CASE 3 (Figs. 11-C and C')

A boy, aged three years, was thought by his parents to have lost considerable vision during the preceding month. They were also certain that his eyes had protruded more than those of a normal child since birth. There were no unusual circumstances connected with his delivery. His father and mother appeared to be normal persons.

Physical examination. The only abnormalities found on physical examination were those of the head and eyes. His skull was approximately normal in size and shape with perhaps a slightly increased anteroposterior diameter; a slightly elevated ridge ran vertically in the forehead following the line of the metopic suture.

Eye findings. There was proptosis but the lids closed readily and there was no divergence nor was there facial deformity such as was seen in the preceding cases. Both pupils reacted sluggishly. The only other abnormality of the eyes was the change in the fundi. The disc in the right eye showed marked pallor with somewhat irregular edges while that of the left eye showed papilledema especially at the superior and inferior poles while there was some pallor of its temporal portion. His vision consisted of ability to grope his way about the room and to detect at close range the presence of large objects two or three inches in diameter.

X-ray examination showed the coronal, lambdoid, and sagittal sutures to be entirely closed. Even the minor suture lines in the mastoid region were not visible. The convolutional markings were greatly increased as were the grooves of the venous sinuses.

Operation. A decompression procedure on the skull was decided upon in the hope that some little vision in the left eye might be retrieved and for the prevention of other consequences of increased intracranial pressure. The operation consisted of removal of a strip of bone from the skull three cm. in width, following approximately the line of the coronal suture and extending from one zygoma to the other. There was uneventful recovery from the operation.

Ten days after the operation there was bulging along the line of the craniotomy. The fundi appeared the same as before surgical treatment. The vision seemed unchanged. As a means of further reducing the intracranial pressure a subtemporal decompression was done. Twenty-three days later though there was little change in his vision he was more active and appeared normal in his behavior except for the loss of vision.

Five months after the operation there still was marked bulging of the scalp along the line of craniotomy. The skull itself showed no great change in shape. The craniotomy continued open though at some points spicules of bone could be felt attempting to close the defect. There was no change in the amount of proptosis. The right disc showed consecutive atrophy as had been seen at all previous examinations. The left disc now showed consecutive atrophy where papilledema had been noted at all previous examinations. He appeared to see slightly better with the left eye than with right.

Seven months after operation (figs. 12-C and C') though consecutive optic atrophy was present in both eyes, his vision with the left eye was better than when he was first seen when papilledema existed in this eye. Elevation of his scalp continued to be present over the line of the craniotomy though its extent was somewhat diminished. His mental condition had greatly improved. He was very alert and he behaved like a normal child except for his lack of vision.

COMMENT

The three patients presented illustrate much of what has been learned about premature synostosis and its sequelae:

Case 1 had a brachycephalic skull with partial compensation; optic atrophy was present in one eye, the other was nearly normal. Facial deformity was present.

Case 2 had a scaphocephalic skull with partial compensation and facial deformity; the discs of both eyes appeared normal.

Case 3 had an almost normally shaped skull, with marked decompensation and almost complete blindness which was due to optic atrophy caused by increased intracranial pressure.

Case 1 illustrates the inadvisability of deroofing the orbits before regulation of intracranial pressure has been obtained by craniotomy. Case 2 shows the advantage that may be obtained by regulating intracranial pressure before deroofing of the orbits or the orbital canals is done and the further advantage of early surgical treatment. Case 3 demonstrates that almost complete blindness can occur before the third year of life unless measures for reduction of intracranial pressure are instituted.

One gains the impression, therefore, that from the standpoint of preventing blindness or the other sequelae of craniostenosis, the type of the skull is unimportant; the presence of facial deformity or the presence of other evidence of embryologic failure such as syndactyly is unimportant. For the prevention of blindness two factors alone are important, the amount of decompensation of

the skull with resulting increase in intracranial pressure and the amount of kinking or stretching of the optic nerve within the canal due to flattening of the skull base.

Permanence of the decompressing effect of surgery at least through the third year of life is of great importance. Whether this can best be accomplished by the use of tantalum foil, polyethylene film, or by other measures can best be determined by neurologic surgeons, though there seems to be considerable unanimity of opinion that the interposition of foreign material such as polyethylene film adds greatly to the chances of success by delaying skull closure. That artificial suture lines must remain open at least until the third year of life appears evident.

Though a few neurologic surgeons have labored diligently toward a solution of the problem, standardized surgery for the condition is not generally used. It would seem that most of these patients, if found in the first year of life, could be helped; it seems further that the control of intracranial pressure before deroofing of the orbits directed against proptosis must be done. Further the tendency of these young skulls to regenerate bone with great rapidity demands that retardation of bone proliferation be delayed by the use of polyethylene film or similar method.

With Monthus and Chennevière, with Faber and Towne, with Fairman and Horrax, and with Ingraham, Alexander, and Matson, we must agree that, if the results of premature synostosis are to be relieved, early operation, before the greatest growth of the brain occurs, must be instituted. Because these patients often seek first the advice of the ophthalmologist or the pediatrician those who treat the eyes and those who care for children must be alert to the responsibility of early diagnosis.

Permanent arrest of optic atrophy, and permanent prevention of mental retardation can be accomplished by properly executed surgical treatment of the skull, when such operation is performed at a sufficiently early age.[20, 21, 33, 65]

Conclusions

Craniostenosis, or premature synostosis, or craniofacial dysostosis is, as explained by Mann, a part of an embryologic failure of the mesoderm which may involve other parts of the body.

The disease may, and often does, affect the interstitial portions of bones of the skull while involving the suture lines.

Crouzon's disease and Apert's disease are not separate entities but are craniostenoses with associated facial deformities, syndactyly, or other deformities of the body which are due to embryologic irregularity.

A classification of skull types acceptable to all observers has not yet been produced.

Optic-nerve atrophy in patients having this disease may be consecutive to papilledema or it may be primary and due to compression of the nerve in the flattened optic canal or it may arise from kinking of the nerve at its exit from the canal or from stretching of the nerve.

Blindness which is due to craniostenosis can be prevented by properly applied surgical treatment directed against the disease at a sufficiently early age.

Operation on the skull has greatly improved the prognosis in patients having the disease but the procedures are not yet standardized.

When proptosis requires deroofing of the orbits or when constriction requires opening the orbital canals, control of the intracranial pressure must first be accomplished to prevent further proptosis or even evulsion of the globe, resulting from surgical edema.

Control of the intracranial pressure, at least until the third year of life, seems to be necessary. Wrapping polyethylene film or similar substance over the cut edges of bone is a valuable adjunct in delaying closure of the craniotomy opening.

Surgical treatment of the skull before the end of the first year of life and preferably

in the first six months is necessary if damage to the optic nerves is to be prevented. Other sequelae may be alleviated at even later dates.

Three cases of craniostenosis are reported.

I am indebted to Dr. F. P. Calhoun, Jr., for permitting me to use Case 2 and to Dr. Oliver A. Arteaga for Case 3.

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CRANIOSTENOSIS*

Report of 22 cases

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Craniostenosis is a term used to designate a group of clinical entities whose common underlying cause is premature and abnormal fusion (synostosis) of the cranial sutures. Many of these cases have a common symptomatology manifest by varying degrees of optic atrophy, convulsions, headaches, and mental deficiency secondary to increased intracranial pressure. Others present only the external cranial deformity without any symptoms of increased pressure at any time during life, the only evidence thereof being the convolutional markings of the skull roentgenographically.

Since these defects have their origin in abnormal union of the cranial bones, certain facts regarding the normal development of the cranium warrant review.[1] At birth in full-term infants, the bones of the vault are separated and the anterior and posterior fontanelles are open. The posterior fontanelle closes by the second month and the anterior fontanelle between the 11th and 22nd months. The interfrontal or metopic suture fuses before birth. Between the sixth and 12th months the bones of the vault become interlocked, but not fused.

Growth in thickness of the skull takes place under the periosteum. Growth in the area of the articulating margins of the bones of the skull produces increased width of these bones. Ordinarily the skull does not become rigid until the child has reached the 10th year, hence elevated intracranial pressure in children is likely to result in increased size of the skull rather than in papilledema. The growth of the skull corresponds normally with growth of the brain.

When the period of growth has terminated for the most part, obliteration of the suture line commences. The coronal suture is first to become obliterated, then the sagittal, and, finally, the lambdoidal suture. The process of fusion commences on the internal aspect of the suture line. Complete disappearance of the suture lines on the external surface does not occur until the third or fourth decade or later.

Etiology

Crouzon and Regnault[2] felt that an inflammation occurred around the sutures causing premature synostosis and subsequent arrest of growth.

Ida Mann,[3] in discussing the etiology of oxycephaly, pointed out that fetal rickets, syphilis, fetal meningitis, and osteitis from metastatic infection in utero have little significance in the etiology of this skeletal deformity. She classifies it as a true developmental anomaly of germinal origin and places the fundamental defect in the mesoderm which goes to make up the bones of the base and sides of the skull.

Park and Powers[4] have pointed out that the defect is in the germ plasm which manifests itself by premature synostosis. They feel that the site of the congenital defect is the interstitial mesenchyme which normally separates the skull bones in their suture lines. The defective interstitial mesenchyme of the involved suture lines fails to produce new bone growth, which tends to produce early calcification of the suture lines.

Pathology

The outstanding fact is that union of opposing bones, in the form of an actual fusion rather than interlocking, produces craniostenosis. Interlocking of the cranial bones

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does not inhibit growth at the site of interlocking, but fusion seemingly does.

Virchow[5] proposed that growth is inhibited in a direction perpendicular to the synostosed bones, and compensatory growth occurs in other directions. The premature synostosis eventually results in a skull which is unable by normal growth stimulus to increase in capacity sufficiently to accommodate a normal and rapidly growing young brain. The intracranial pressure consequently is increased, but compensation of the intracranial tension may be attained by the following means.

The thin skull bones may bulge, forming a boss, the nonsynostosed sutures may be separated, forming dehiscences, or a compensatory overgrowth may occur along the nonsynostosed sutures increasing the measurement of the skull in a direction perpendicular to the nonsynostosed sutures. Frequently the anterior fontanelle is found to remain beyond the first year of life, with pulsating intracranial contents bulging through it.

The intracranial pressure depresses the fossae, especially the middle and posterior fossae, increasing the vertical diameter of the cranial vault. Cribriform convolutional markings are eroded on the inner table of the skull by the elevated pressure. Because the weakest region of the base of the skull is the sella turcica, this area may be enlarged in all its measurements by the increased pressure with no erosion of any of its parts.

Expanding intracranial hypertension depresses the roof of the orbit abnormally, so that it slopes downward posteriorly, thereby being more vertical than normal. The peculiarly shaped and hypoplastic orbit forces the normal orbital contents forward, creating a conspicuous exophthalmos.

In the event that the intracranial hypertension is not adequately compensated by secondary bony changes of the skull, signs of decompensation appear. Papilledema or secondary optic atrophy is a reliable sign of decompensated intracranial hypertension.

Not all writers are in accord as to the etiology of the optic atrophy.

Krause and Buchanan[6] state that the optic atrophy can be the result of the intracranial hypertension, or mechanical traction on the nerves due to lengthening of the optic canal or constriction of the nerves by the narrowed optic foramina. Walsh,[1] however, states that the optic foramina are usually quite normal.

Behr[7] concluded from an anatomic study of four cases of oxycephaly that there is a shift of the roof of the optic canal backward over its floor, and that the carotid artery passing under this posterior projection of the canal roof compresses the nerve.

Ida Mann[8] feels that the optic atrophy of oxycephaly is either secondary to papilledema or due to a kinking of the optic nerve at the optic foramen as it exists from an abnormally downward directed optic canal and courses sharply upward to follow the abnormally upward slope of the distorted orbit.

Rubin[9] remarks that the cases of unilateral optic atrophy are not explained by increased intracranial pressure. However, the majority of writers feel that the secondary optic atrophy is the sequel to a previous papilledema.

The premature synostosis of the zygomatic, maxilla, alisphenoid, temporal, pterygoid, and palatine bones results in a hypoplasia of the bones of the face and orbit, a high arching of the palate and locks the orbits in the widely separated, laterally directed fetal position (hypertelorism).

The skull is the only portion of the skeletal system involved in the premature synostosis, although bilateral, symmetrical syndactylism of the upper extremities has been recorded as an associated finding.

Classification

Either all or only some of the cranial sutures may be prematurely fused. Thus, depending on which sutures are involved, the craniostenoses may be classified into different types. The cases in this survey were classified as follows:

1. Oxycephaly—tower skull—outstanding characteristic is the height.
   a. Advanced (complete craniostenosis) —there is premature fusion of all the cranial sutures.
   b. Incomplete—the anterior fontanelle may remain open sufficiently long that increased intracranial pressure may account for actual protrusion of brain substance through it.
2. Brachycephaly—premature closure of the coronal suture.
3. Scaphocephaly—boat - shaped head—premature closure of the sagittal suture.
4. Plagiocephaly—premature union of the sutures in one half of the head and a compensatory development in the other half.
5. Craniofacial dysostosis (Crouzon's disease)—besides the stenosis of the cranial sutures there is hypoplasia of facial bones.
6. Hypertelorism—abnormally wide separation of the eyes.

Case reports

These types are illustrated with cases that have been admitted to the Hospital for Sick Children, Toronto.

1. Oxycephaly

Synonyms — acrocephaly, tower - skull, steeple-head, turritum caput, tête a la Thersite, turricephaly (dome-shaped head), Spitzkopf.

The defect usually occurs in a single member of a family. The deformity as it involves the skull is seen to vary within wide limits. The outstanding characteristic of the skull is its height, hence the term "tower-skull." The deformities are high, dome-shaped or pointed skull, high forehead, short anteroposterior diameter, widening or bulging temporal fossae, flattened cheek bones, feebly marked superciliary ridges, shallow orbits, prognathism, high narrow palate arch, deviation of nasal septum, and obliteration of the sutures with bony thickening at their previous sites. These abnormalities of the skull in varying proportions are often combined with syndactylism.

Roentgenographically there is a complete absence of suture lines in fully developed cases. Increased intracranial pressure accounts for convolutional atrophy of the brain and thinning of the calvarium particularly in the frontal region. It also accounts for the "digital" impressions which are the most prominent feature in X-ray films. The middle fossa is often depressed and the anterior fossa shortened. The anterior fontanelle may remain open sufficiently long that increased intracranial pressure may account for actual protrusion of brain substance through it.

Signs and symptoms

Headache is an almost constant complaint. It often disappears or becomes less severe at about eight years of age. This is attributed to a cessation of growth of the brain. From the eighth year to the onset of puberty there is only slight increase in the size of the brain. At puberty headache again becomes troublesome. Convulsions are not uncommon. Mentality is often subnormal.

As for the ocular signs, the exophthalmos is due to flatness of the orbits. Wide separation of the eyes and external squint are characteristic features.

Loss of vision occurs frequently and is often present in some degree early in life, but moderately good vision remains until the age of six or seven years in a majority of severe cases. In some mild cases vision remains relatively good throughout life. The probable causes for the loss of vision have been mentioned previously.

Medullated nerve fibers are present in many cases. Distinctive visual fields have been reported. Due to the low position of the base of the skull and the elevation of the vertex, the optic nerves must travel uphill to attain the optic foramina. As a result each optic nerve is stretched and pressure upon

the lower part of the nerve accounts for defects in the upper fields.

PROGNOSIS

Individuals who suffer from the more severe grades of oxycephaly rarely reach maturity. Those with lesser degrees may live to an advanced age.

a. *Advanced oxycephaly (complete craniostenosis)*

CASE 1

J. U. was admitted to hospital in August, 1950, when he was aged six years (fig. 1). The history was that he had had poor vision since he was two years old and his eyes started to bulge about the same time. He had been troubled with frequent headaches for one year.

On examination there was some exophthalmos and prominence of the forehead. Examination of the eyes showed the vision to be limited to large objects, 15 degrees alternating exotropia, a horizontal nystagmus, and bilateral optic atrophy.

X-ray examination of the skull (fig. 1a) revealed deep convolutional markings indicative of long-standing, severe increased intracranial pressure. The suture markings were all obliterated. The sella turcica was markedly enlarged. The base of the middle cranial fossa appeared enlarged in the anteroposterior diameter. The frontal bone of the skull showed a moth-eaten appearance suggestive of an erosion effect on the diploie.

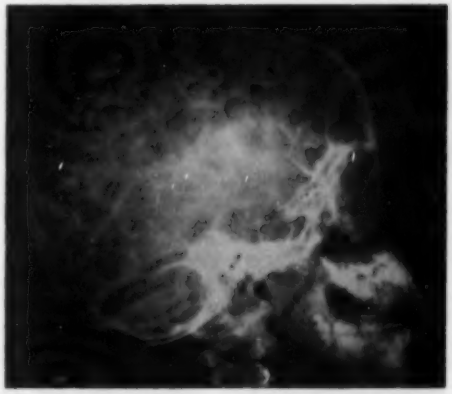

Fig. 1a (Koziak). Advanced oxycephaly. Suture markings are all obliterated.

In September, 1950, a craniolysis was per-

Fig. 1 (Koziak). Advanced oxycephaly (complete craniostenosis).

Fig. 1b (Koziak). Advanced oxycephaly. Following surgery.

Fig. 1c (Koziak). Advanced oxycephaly. Following surgery.

formed by removing strips of bone along the coronal and lambdoid sutures and in the sagittal plane just to the right of the sagittal suture. The bone margins were wrapped with polyethylene film. Figures 1b and 1c show the postoperative appearance.

The last examination of this boy was in June, 1952. He had no more headaches, but his vision was not improved and was poor. This is an example of a child who has suffered irreversible consequences of craniostenosis.

Fig. 2 (Koziak). Advanced oxycephaly. Following surgery.

CASE 2

I. L. was admitted to hospital in November, 1934, when she was seven years of age. The relevant facts in the history were that an exophthalmos was noticed for two years and she had been having headaches for one year.

Examination of the eyes showed vision to be 20/30 in each eye. There was some bilateral proptosis. Fundus examination showed marked tortuosity of the vessels in each eye and papilledema of both discs.

X-ray studies of the skull showed evidence of considerable amount of irregularity involving the inner table of the skull, probably due to some pressure exerted from the

Fig. 2a (Koziak). Advanced oxycephaly. One year following carniotomy.

Fig. 3 (Koziak). Incomplete oxycephaly. Intracranial contents are bulging through a patent anterior fontanelle.

intracranial contents. No definite evidence of any suture lines was seen.

When the girl was eight years of age, a two-stage circular craniotomy was done. A portion of the roof was separated from the remaining parts of the vault (fig. 2). There was recession of the papilledema following the operation and she was free from headaches and the discomfort she had experienced previously. Figure 2a is a photograph of the patient when she was nine years of age, about one year following the craniotomy.

When she was aged 21 years, she again began to have severe headaches. The craniotomy was repeated and since then she has been having headaches only when overtired and they are not severe.

She was seen in September, 1952, when her age was 25 years. She has no trouble doing her work as an office clerk. Vision at this time was: O.D. 20/30; O.S. 20/20. There was considerable evidence of exophthalmos. The fundi showed some blurring of the disc margins and tortuous veins.

b. *Incomplete oxycephaly*

CASE 3

This is an example of oxycephaly where all the sutures are not involved and the craniostenosis is not complete. The photographs were taken when the patient was nine months of age (fig. 3).

From the pictures it appears that there has been partial fusion of the sutures, causing the intracranial contents to bulge through a patent anterior fontanelle. The deformity of the head had been present since birth.

She was able to follow light. There was marked proptosis, the eyes were divergent, and a fine nystagmus was present. Examination of the fundi showed papilledema of the right disc and optic atrophy, probably secondary, of the left disc.

When she was seen at the age of 11 years, she was mentally retarded and her speech was poor. Her vision was: O.D., counts fingers at four feet; O.S., true light projection.

2. BRACHYCEPHALIC TYPE OF CRANIOSTENOSIS

In this condition the head is wide and it is attributed to premature closure of the coronal suture. As a result growth occurs laterally and vertically. The intracranial pressure is not so likely to be increased as in complete oxycephaly since the skull can expand in two directions.

CASE 4

Figure 4 shows an example of this type of craniostenosis. The photograph was taken when the boy was aged two years. His mother, one sister, and one brother had similarly shaped heads and faces. The boy has had no symptoms that could be attributed to the craniostenosis.

On examination there was bulging of the frontal and parietal regions and the eyes were wide apart.

Roentgenologic examination (figs. 4a and 4b) showed that the skull vault was large in respect to the facial bones. The frontal

Fig. 4 (Koziak). Brachycephaly. The patient at the age of two years. The head is abnormally wide.

bone was considerably enlarged and there was some bossing of it. The coronal sutures were absent or fused and the anterior fossa was much smaller than usually seen and the middle fossa appeared larger. There appeared to be marked widening of the frontonasal processes.

This boy was seen in September, 1952, when he was six years of age. The vision then was 20/30 in each eye, corrected, and the fundi were normal.

3. Scaphocephaly

This term signifies a boat-shaped head. The head is narrow and excessively long in its anteroposterior diameter, and the vertex is high. It is attributed to premature closure of the sagittal suture which allows for further expansion in the anteroposterior and vertical diameters only. The ocular signs, exophthalmos, optic atrophy, and squints, which are usually divergent are similar to those of oxycephaly.

Fig. 4a (Koziak). Brachycephaly. Coronal sutures are absent.

Case 5

This child was admitted to hospital in October, 1951, at the age of 10 months (fig. 5). There had apparently been no symptoms, but the reason for seeking medical attention

Fig. 4b (Koziak). Brachycephaly. Frontal bone is enlarged and bossed.

Fig. 5 (Koziak). Scaphocephaly. The patient is aged 10 months. The head is excessively long.

was the shape of the head, which was long and narrow.

A strip of bone about a quarter-inch wide was removed from the lambdoid to the anterior fontanelle on the right and left sides. Polyethylene film was placed on the bone margins. Figures 5a and 5b show the postoperative appearance. It is seen that the sagittal suture is not present and the coronal and lambdoid sutures are patent.

4. Plagiocephaly

This is a form of craniostenosis in which there is premature union of the sutures in one half of the head and a compensatory development in the other half. As a result the head seems normally developed on one side and underdeveloped on the other.

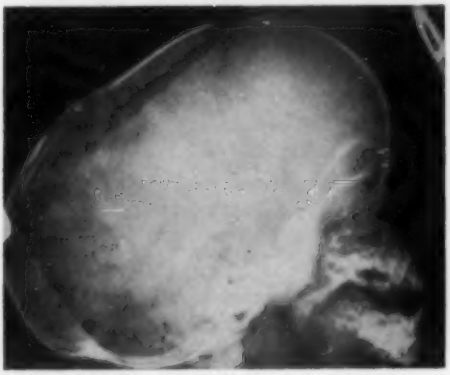

Fig. 5a (Koziak). Scaphocephaly. Following surgery.

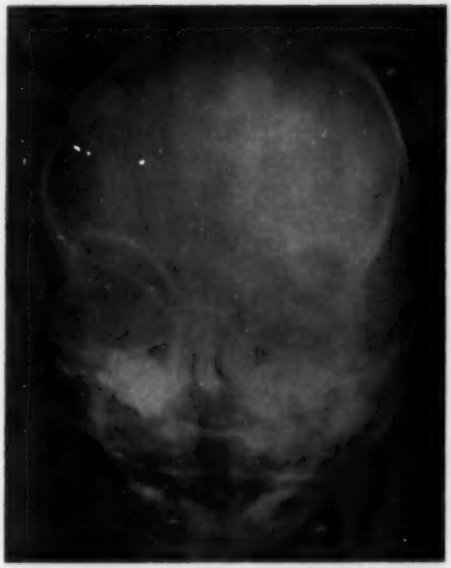

Fig. 5b (Koziak). Scaphocephaly. Following surgery.

Case 6

The photograph of this girl was taken when she was five years of age (fig. 6). The asymmetry of the face was noticed at six months of age. Examination showed the cranial vault to be asymmetrical. The frontal bones on the right were prominent and flattened on the left. The maxilla was smaller and flattened on the right.

It was impossible to get a correct estimate of the visual acuity due to mental retardation. There was paresis of the right superior rectus. The fundi were normal except for blurred disc margins due to glial proliferation, and there was no true papilledema.

X-ray examination of the skull showed unilateral craniostenosis. The sutures were still open on the right side with resultant enlargement of the right side as compared with the left, giving an asymmetry (figs. 6a and 6b).

5. Craniofacial dysostosis (Crouzon's disease)

In this condition, besides the stenosis of

Fig. 6 (Koziak). Plagiocephaly. The patient is aged five years. Showing asymmetry of face.

Fig. 6b (Koziak). Plagiocephaly. Lambdoid suture is absent on one side.

Fig. 6a (Koziak). Plagiocephaly. Coronal suture is absent on one side.

the cranial sutures, there is hypoplasia of the facial bones. This distinctive craniofacial deformity is present at birth and it includes exophthalmos, hypertelorism, parrot-beak, and frequently an associated divergent strabismus. The upper face is broad, having a recessed appearance, the palate is highly arched, producing nasal obstruction.

It is usually within the first few months of infancy that the peculiar shape of the skull becomes manifest. There may develop a scaphocephaly or acrocephaly and/or the skull may have frontal, parietal, or occipital bosselations. The vertical diameter of the skull usually becomes increased and the ears are tipped posteriorly and pulled inferiorly to a lower plane than normal.

Case 7

J. G. was admitted to hospital in April, 1952, at the age of 15 months (fig. 7). This child was born with multiple defects, but physical progress had apparently been nor-

mal. Besides the deformity of the head and marked exophthalmos there was a cleft palate and syndactylism in the upper and lower extremities. The eyes showed a wide interpupillary distance, and the discs appeared paler than normal.

An X-ray study of the skull revealed marked decrease in the anteroposterior diameter. The fontanelle was wide open and there appeared to be bulging at it. The coronal suture was obliterated except for a short portion near the bregma. The occipital and posterior parietal regions of the skull showed marked increase of the convolutional markings (fig. 7a).

In May, 1952, a craniotomy was performed by removing a strip of bone transversely from temporal to temporal region and covering one margin of the bone with polyethylene film.

Fig. 7a (Koziak). Craniofacial dysostosis (Crouzon's disease) by X-ray examination.

Fig. 7 (Koziak). Craniofacial dysostosis (Crouzon's disease). The patient is aged 15 months.

6. Hypertelorism

There is an abnormally wide separation of the eyes. In these cases the interpupillary distance may be as much as 84 or 85 mm., whereas in average individuals it is slightly over 60 mm. Greig[9] considered the cause to be an overgrowth and early ossification of the lesser wings of the sphenoid bones leading to an abnormally wide separation of the orbits. This wide separation amounts to a fixation of the orbits in their fetal state.

There is not usually an associated increased intracranial pressure. Consequently optic atrophy is not often seen associated with hypertelorism. External squint is said to be present frequently. The intelligence of affected individuals is often normal, but may be subnormal. Other deformities of the skull, such as oxycephaly, may show some degree of hypertelorism.

Figure 8 is an illustration of hypertelorism in a 21-month-old child. It is obvious that in this case, as in many of this group, the

Fig. 8 (Koziak). Hypertelorism. Showing wide interpupillary distance and divergent strabismus.

hypertelorism is not the only cranial deformity.

Summary

During the years 1928 to 1952, inclusively, 22 cases of craniostenosis were admitted to the Hospital for Sick Children, Toronto. There were grouped as follows:

1. Oxycephaly	
(a) Advanced (complete craniostenosis)	3
(b) Incomplete	6
2. Brachycephaly	4
3. Scaphocephaly	5
4. Plagiocephaly	3
5. Craniofacial dysostosis	1
6. Hypertelorism	5

If these cases are totalled, they make 27 cases instead of 22. The reason for this is that the cases of hypertelorism were also included in other groups, that is, three cases of hypertelorism were also brachycephalic and the two others showed oxycephaly.

As to the effects of these conditions on the ocular structures and visual acuity, no statement based on statistical evidence can be made due to the difficulty of making an accurate survey. Several of the patients have died, quite a number are still too young for an accurate estimation of visual acuity, and in some no record could be found of an ophthalmologic examination.

A general observation can, however, be made from the cases studied:

If craniostenosis sets in early enough, papilledema will occur, which, if allowed to remain long enough, will be followed by optic atrophy with deleterious effects on the visual acuity. Thus a valuable diagnostic aid in investigating loss of vision, especially in children, is an X-ray study of the skull. It seems apparent from the cases of craniostenosis herein surveyed that, if room for expansion of the cranial contents is provided by surgical intervention, good visual acuity may be preserved, and if there has already been some loss of vision, it can be prevented from progressing further.

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STABILITY OF AQUEOUS SOLUTIONS COMMONLY EMPLOYED IN THE TREATMENT OF PRIMARY GLAUCOMA*

PART I. THE PHARMACOLOGY OF MIOTICS

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INTRODUCTION

Certain requirements should be fulfilled in the preparation of aqueous solutions ordinarily used in the treatment of primary glaucoma. If the requirements for an ideal ophthalmic solution can be reasonably well satisfied, then a prescription for the solution may be written knowing that the patient will obtain the utmost continued benefit with little irritation from the active ingredient.

The requirements for the ideal ophthalmic solution have been noted by Morrison and Truhlsen.[61] The requirements are that the solution should be (a) free and remain free of micro-organisms for a reasonable length of time, (b) nonirritating, (c) of optimum physiologic activity, (d) stable, (e) of low toxicity, (f) of low surface tension or of high wetting power, (g) sterilizable, (h) compatible, (i) of low cost.

Most of the requirements necessary to render a solution ideal for the treatment of primary glaucoma have been well examined. Of these, stability is of prime importance, particularly when the solution is to be used in the treatment of a sight-destroying disease such as glaucoma.

It is not unusual for a patient to live a great distance from a skilled pharmacist. The solution compounded may therefore have to remain active for weeks or months. It is not uncommon for the solution to freeze in poorly heated homes or be kept at high temperatures for long periods during the summer months. It is therefore important that the ophthalmologist know how time and temperature influence the physiologic activity of a solution of any of the commonly employed miotics.

The pertinent literature concerning the pharmacology of the miotics, drug passage, and the compounding of ophthalmic solutions will be reviewed. Particular reference will be made to the hiatus in our understanding of solution stability. Experimental work which narrows the gap in our knowledge of pilocarpine, physostigmine, neostigmine, methacholine, and carbachol solution stability will be reported in detail.

PHARMACOLOGY OF MIOTICS

GENERAL CONSIDERATIONS

The accepted nonsurgical treatment of primary glaucoma rests chiefly with the miotics. The manner of their action is not definitely understood although a tangible effect is noted, that of a reduction in the intraocular pressure.

Duke-Elder[32] points out that control of the tension is almost the only therapeusis available at this time. The miotics produce conditions which should be considered as factors in tending to reduce the intraocular pressure. Stimulation of the iris sphincter pulls the iris taut and thereby increases the space in the chamber angle. Contraction of the longitudinal fibers of the ciliary muscle pulls on the scleral spur, and in turn the tissues of the angle are spread and the canal of Schlemm opened.[32] Ciliary-body spasm reduces the blood flow to the ciliary processes and thus lowers the output of aqueous.[33]

Duke-Elder[32] states that a sustained contraction of the ciliary muscle reduces the blood pressure in the anterior segment of the eye by occluding the posterior ciliary arteries and in this way aids the return circulation. He believes that the hypotensive action of eserine and pilocarpine is due to their

* From the Department of Ophthalmology, University of Nebraska College of Medicine. Candidate's thesis presented toward membership in the American Ophthalmological Society, accepted by the Committee on Theses.

increasing the flow through the venous capillaries, and the opening out and dilation of new functional capillary districts.[53]

The miotics may favorably influence the blood-aqueous barrier,[55] and they all produce vasodilatation to a varying degree. Vasodilatation may increase the pressure in the normal eye, but in glaucoma some of the stasis is relieved by the improved state of nutrition associated with a better blood supply.[52] Sugar[106] believes that vasodilators cause a greater surface of vascular wall to be exposed to the aqueous with consequent increased aqueous absorption.

A knowledge of the mechanism by which the intraocular muscles are caused to contract is necessary for the understanding of the action of the drugs used in the treatment of glaucoma.[90] The neurohumoral theory of the transmission of nerve impulses most satisfactorily explains the action of the miotics.

This theory, according to Goodman and Gilman,[46] holds that "nerve impulses effect responses in muscles and glands through liberation of a chemical substance which acts as a major local exciting agent."

There is strong evidence to indicate that the chemical mediator or effector substance is acetylcholine.[47] This substance is believed to exist in the tissues in an inactive nondiffusible form which cannot be destroyed by the enzyme cholinesterase. Nerve impulses, however, change acetylcholine to a diffusible active effector substance which is vulnerable to the action of cholinesterase.

This specific enzyme, cholinesterase, splits acetylcholine into choline and acetic acid. Its action is rapid and brief. Cholinesterase is inactivated temporarily by physostigmine, neostigmine, and carbachol, and irreversibly by di-isopropyl fluorophosphate.

Acetylcholine transmits nerve impulses across any synapse in the body and transmits nerve impulses to skeletal muscles. In this respect acetylcholine is like nicotine; hence, this action is termed nicotinic.[96] Acetylcholine also activates the effector cells in structures (blood vessels, sweat glands, and the muscles of the iris sphincter and ciliary body) supplied by the postganglionic fibers of the parasympathetic system.

Its action is similar to that produced by muscarine; hence, this response is termed muscarinic.[96]

The action of acetylcholine is not limited to the parasympathetic nervous system but is responsible also for the conduction of impulses across the synapses in the sympathetic pathways. The structures supplied by the sympathetic nervous system are, however, activated by the liberation of an adrenalinlike substance called sympathin.[107]

Drugs which induce a response like that of acetylcholine are classed physiologically or chemically as cholinergic drugs. Those which mimic the effect of parasympathetic nerve stimulation are classed anatomically as parasympathomimetic.

Stimulation of the intraocular muscles is believed to occur, according to Scheie,[90] in somewhat the following manner: a nerve impulse causes the release of an effector substance (acetylcholine) at the nerve ending. This substance initiates a similar impulse in the next nerve cell in the pathway and is then immediately inactivated by an antagonistic substance (cholinesterase). This process recurs at each synapse until the organ which the nerve supplies is reached. Here an effector substance is released which causes the cell to assume its physiologic activity.

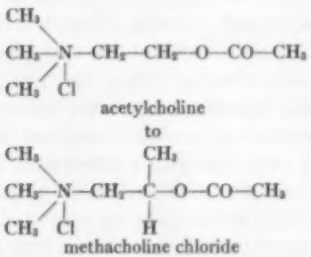
The action of the effector substance probably takes place on an irritable patch on the surface of the effector cell.[125] This point is probably not differentiated histologically but only physicochemically.[46]

Goodman and Gilman[46] quote Loewi as doubting if the term "myoneural junction" is accurate. Certainly the older concept that nerve endings are stimulated or depressed by drugs is not tenable, inasmuch as responses can be elicited after complete degeneration of nerve elements and in the embryonic structures before nerves have grown to the organ.[46]

Miotic drugs act either directly on the effector cells of structures innervated by the parasympathetic nervous system or indirectly by inhibiting the action of cholinesterase, which in turn allows the accumulation on the effector cell of physiologically produced acetylcholine.

Swan[116] has divided the drugs which induce miosis into direct stimulatory miotics, indirect stimulatory miotics, and combined direct and indirect stimulatory miotics. The drugs that directly stimulate the effector cell of the iris sphincter are acetylcholine, methacholine, and pilocarpine. The drugs that indirectly stimulate the iris sphincter are physostigmine, neostigmine, and di-isopropyl fluorophosphate. A combined direct and indirect stimulation of the iris is exhibited by carbachol[116] and possibly by neostigmine.[89]

Methacholine chloride U.S.P. (acetyl-beta-methylcholine chloride; mecholyl® chloride) is a synthetic choline derivative occurring as fine, white, odorless, bitter, deliquescent crystals which are freely soluble in water.[49] Its stability is greatly enhanced over acetylcholine by the substitution of a methyl group for a hydrogen molecule in the beta position.[116]



Methacholine chloride is a direct stimulatory miotic producing its specific effect on the effector cells supplied by the parasympathetic nervous system.[116] The drug has a more prolonged action than acetylcholine. Its maximal effect on the pupil of a glaucomatous eye occurs in less than one hour, lasts for several hours, and is followed by a short period of decreased activity.[108]

Adler and Scheie[1] observed that mecholyl® in less than 15-percent solution had no effect on the normal pupil even thought Myerson and Thau[92] found in some persons with normal eyes that a one-percent solution produced miosis.

The local application of methacholine produces vasodilatation and, in the normal eye, a drop in intraocular pressure of three to five mm. Hg.[82] Mecholyl® stimulates accommodation slightly more than does pilocarpine.[28]

The action of methacholine is so rapidly terminated by cholinesterase that systemic effects seldom follow even repeated instillation of the drug.[116] A marked drop in blood pressure, sweating, salivation, nausea, urinary urgency, and dyspnea may follow too frequent instillation, particularly if the corneal epithelium has been damaged by local anesthetics and tonometry.

A general systemic reaction usually follows immediately the intramuscular or retrobulbar injection of the drug, and death may ensue from bronchial constriction and respiratory failure if the patient is asthmatic or markedly allergic.[23] Dunphy[35] has seen three near-fatalities from this method of administration.

Methacholine in aqueous solution penetrates poorly, particularly if the corneal epithelium is intact.[116] Its penetration may be increased by the use of a wetting agent such as benzalkonium chloride, by corneal massage, and by preceding the use of the drug with a drop of 0.5 percent tetracaine hydrochloride.[35, 116]

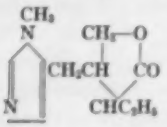
Swan[116] believes the most effective way of administering methacholine is by iontophoresis. Intense miosis can be obtained by this method in just a few minutes.

Patients with acute congestive glaucoma of the shallow-chamber type react favorably to the use of methacholine.[116] It is usually employed in 10- to 20-percent solution and is given preferably by iontophoresis.[109, 116]

Clarke[23] suggested the use of a combination of methacholine and neostigmine as a

means of combining a direct and indirect action and thereby obtaining a result greater than that obtained with either of the drugs alone. Swan,[116] however, felt that if the iris muscle is reactive either methacholine or neostigmine alone is sufficiently potent, and if the muscle is badly damaged, any miotic combination is ineffective.

Pilocarpine. The lactone of pilocarpic acid is the chief alkaloid of the South American shrubs, Pilocarpus jaborandi and Pilo-



carpus microphyllus.[15, 53, 90] It was isolated in 1871 by Hardy and was first used in ophthalmic practice by Weber in 1876.[53]

The base of pilocarpine is a viscid, colorless oil which forms dextrorotatory salts with mineral acids. The hydrochloride salt consists of hygroscopic, colorless, translucent crystals.[53] The nitrate salt is less soluble than the hydrochloride,[53] and consists of slightly bitter, shining, colorless crystals.[53]

Pilocarpine is not affected by cholinesterase[124] and acts directly on the muscle cells of the ciliary body, the sphincter pupillae, and on other cells innervated by postganglionic cholinergic nerves.[18] Because of its direct action, pilocarpine continues to stimulate the muscle cell after a complete degeneration of nerve and nerve endings has occurred.[97] It is therefore a direct stimulatory miotic.[116]

It has been supposed that pilocarpine in combination with other miotics has a synergistic or additive action. Swan and Gehrsitz,[118] however, have found that pilocarpine decreases the reactivity of the iris sphincter of the albino rabbit to the subsequent action of physostigmine, di-isopropyl fluorophosphate, and physiologically produced acetylcholine. They suggest that "pilocarpine 'competes' with acetylcholine for the receptor mechanism of the iris sphincter."

Only a slight miotic effect is produced on the rabbit iris by pilocarpine and it has the opposite effect of invariably dilating the pupil of the rat.[57] Adverse reactions may follow its stimulation of the sweat, salivary, gastric, and bronchial glands.[84]

Pilocarpine is a vasodilator of low degree[110] and produces a transitory rise in intraocular pressure followed by a prolonged lowering of the pressure.[88] Miosis begins in about 10 minutes and may last as long as 24 hours.[109] It is usually administered every four hours.[114] After the effect of the drug has worn off, there occurs a transient mydriasis indicative of a partial paresis or decreased reactivity of the sphincter.[57] A moderate contraction of the ciliary muscle followed by a partial paralysis follows the instillation of the drug.[57]

The use of pilocarpine may be continued over a long period of time without the development of an intolerance or irritation. An allergic reaction may, however, eventually occur,[31] and prolonged use can produce follicular conjunctivitis and the development of pigmented synechias.[35] There are few incompatibilities of importance except that of pilocarpine nitrate with benzalkonium chloride.[100]

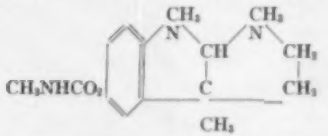
The drug is usually prescribed in a one- to two-percent solution. Sugar[110] has not found concentrations above two-percent to be more effective than a two-percent strength. Dunphy,[35] however, states that a four-percent pilocarpine solution is frequently employed and a solution as high as 10 percent can be used. A minimal pupillary constriction in human beings can be observed with concentrations as low as 0.02 to 0.25 percent.[57]

Physostigmine (eserine) is the principal alkaloid of the Calabar bean, the seed of the African vine Physostigma venerosum,[10] The seeds of the Calabar bean are called "Esere" by the Negroes who inhabit the region of the Old Calabar River of West Africa. The toxic effects of the bean were

used as a poison in their native trial by ordeal.[91]

Fraser,[38] in 1864, isolated and noted the effect on the eye of a pure crystalline form of the alkaloid of the Calabar bean. The structure of physostigmine was proved by Barger and Stedman[7] in 1919 and its synthesis was accomplished by Julian and Pikl[68] in 1935. Laqueur,[73] in 1877, was the first to treat glaucoma with physostigmine, although Argyll Robertson,[90] in 1863, used Calabar-bean extract as a miotic but failed to realize its value in the treatment of glaucoma.

The carbamate structure of physostigmine, explains its pharmacologic behavior and gave the clue that initiated the synthesis of its analog, neostigmine.[17] Physostigmine inacti-



vates cholinesterase and, because it does not directly stimulate the muscle cell, has been referred to by Swan[116] as an indirect stimulatory miotic.

Physostigmine prevents the enzyme cholinesterase from catalyzing the hydrolysis of acetylcholine by competing with acetylcholine for a reactive place on the enzyme. Its carbamate group inhibits the hydrolytic ability of cholinesterase, and as a result acetylcholine remains unsaponified and gains time in exerting its ordinarily short effect at all cholinergic locations in the body.[116] This competition occurs at both sympathetic and parasympathetic ganglia and at all junctures of cholinergic nerves with glands and muscles.

Leopold and McDonald[78] observed that the sensitivity of the pupil to di-isopropyl fluorophosphate (DFP) was decreased by the prior instillation of physostigmine. Conversely, the pupil exhibited a long-lasting increased sensitivity if the administration of physostigmine was preceded by the instillation of di-isopropyl fluorophosphate. They believe that physostigmine prevents the action of DFP by protecting the cholinesterase from the DFP.

Swan and Gehrsitz[118] found that the sensitivity of the albino rabbit iris sphincter to physostigmine is reduced by the simultaneous, or even more so by the prior, administration of pilocarpine. They postulate that pilocarpine competes with the physiologically released acetylcholine for the receptor substances of the iris sphincter. In this way the effectiveness of the anticholinesterase is decreased.

The alkaloid of physostigmine is unstable[18] and insoluble in water.[123] Therefore, the more stable water-soluble sulfate or salicylate salt[123] of the alkaloid is usually prescribed. These salts in aqueous solution oxidize upon short exposure to air and light, and, although their physiologic activity is retained, they become intensely irritating to the eye.[63] The use of an antioxidant such as sodium bisulfate prevents the solution from becoming unstable and developing a pink color.[77]

Stable physostigmine is frequently irritating to the eye and the development of a follicular conjunctivitis and a low-grade iritis is not uncommon.[111] Buffering the solution so that it is just on the acid side[116] and the addition of small amounts of cocaine[96] may help reduce the irritating tendency of physostigmine. The eye will often tolerate the drug well if its free alkaloid base is administered in oil.[96]

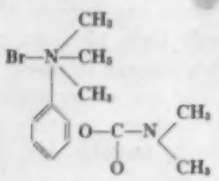
Severe systemic toxic disturbance may occur if physostigmine is frequently used. Its effect becomes accumulative[116] and results in nausea, vomiting, diarrhea, salivation, sweating, weakness, and a drop in blood pressure.[111]

Physostigmine is a vasodilator and, as a result of increased capillary permeability, a diffusion of proteins arises causing a primary transient increase in intraocular pressure.[96] The drug causes marked spasm and hyper-

excitability of accommodation. Miosis is rapid and intense, reaching a maximum in about half an hour and persisting from 12 to 36 hours.[110] The pupil may became smaller than that produced by a strong light and may constrict even more when exposed to a weak light.[51] A minimal human pupiliary constriction occurs with 0.01 percent physostigmine.[57]

Physostigmine is ordinarily prescribed in strengths varying from one-eighth percent to one percent.[96] Few incompatibilities of importance are encountered except for that of physostigmine salicylate with benzalkonium chloride.[100]

Neostigmine (prostigmine®[97]) is a synthetic carbanate alkaloid which may be prescribed as the methylsulfate, or more commonly as the bromide salt:



Neostigmine, first suggested as a miotic by Myerson and Thau,[82] is a white, crystalline powder, odorless, bitter, freely soluble, and stable in aqueous solution,[52] particularly if buffered at a pH of three to four.[96]

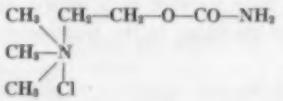
Neostigmine prevents the destruction of acetylcholine by inhibiting the action of cholinesterase,[19] and Riker and his coworkers[89] report that neostigmine also stimulates cholinergic effector cells.

Although the cholinesterase-inhibiting action of neostigmine is similar to that of physostigmine. Scheie[96] believes its miotic effect is less than that produced by physostigmine. Myerson and Thau[82] found the minimal dilution capable of constricting the pupil to be one percent and the optimum concentration to be five percent. A 10-percent solution did not damage the eye.

Clarke[23] was of the opinion that prostigmin® and physostigmine were about equal in affect but that prostigmin® could be used in twice the concentration of physostigmine without causing irritation.

The intraocular pressure is decreased as the concentration of neostigmine is increased. The stimulation of accommodation is marked.[82] Neostigmine is prescribed in a three- to five-percent solution, and its effect may be particularly enhanced if combined with 20-percent mecholyl.[23]

Carbachol chloride U.S.P. (carbamylcholine chloride; carcholin®; doryl®),



a potent, toxic, synthetic derivative of choline, was first prepared by Kreitmair[71] in 1932. It occurs as a white, odorless, crystalline powder which is soluble 1:1 in water.[50]

Carbachol is more stable than acetylcholine or methacholine.[110] The aqueous solution withstands heating and is stable in air.[50] Systemic disturbances from instillation do not occur unless the drug is rapidly absorbed through a damaged cornea.[110] A fall in blood pressure, increased peristalsis, and bronchial constriction are evidences of toxicity.[22]

Sensitization to carbachol rarely occurs.[22] The drug produces vasodilatation and stimulates accommodation. The intense constriction of the iris sphincter and the spasm of the ciliary muscle causes eye and headache which usually abate after the third day of of administration.[22]

Swan found carbachol to have a smooth and prolonged action which was free of the lid twitching that often accompanies the use of physostigmine.[110] He observed that the refractive error could be kept constant if a regular dosage schedule was followed.

Carbachol in aqueous solution does not readily penetrate the intact cornea.[110] This characteristic probably accounts for the erratic behavior that Velhagen[120] noted in using the drug in the treatment of chronic noncongestive glaucoma.

O'Brien and Swan[84] found that increased,

consistent penetration of carbachol occurred if it was placed in a surface-tension reducing agent such as zephiran®. Massage of the cornea through the lids enhanced its penetration. A simpler, more effective means of penetration was obtained by placing carbachol, which has a low affinity for lipids, in a pure petrolatum base.[112]

Carbachol is a direct and indirect stimulatory miotic.[116] Its dual pharmacologic action is accounted for by direct stimulation of the effector cell and by its urethane group inhibiting the action of cholinesterase.[123]

Swan[116] found carbachol's action to be more intense and prolonged than that of pilocarpine. Carbachol is usually prescribed for patients who are sensitive to pilocarpine or in whom pilocarpine falls just short of controlling the glaucoma. It is advantageously employed in eyes in which surgery has been partially successful in controlling the tension.

Carbachol when at the height of its activity does not constrict the pupil as much as does pilocarpine[114] and therefore causes less blurring of vision. The drug has a prolonged action lasting as long as eight to 12 hours.[22] It is therefore effective if prescribed two to three times daily.

Carbachol is best prescribed as a 1.5 percent solution in 1:3,000 zephiran®[55] or as a 1.5-percent ointment, suspending 0.5 gm. of the active ingredient in 33 gm. of petrolatum U.S.P.[22] The patient should be advised that the ointment has been properly placed in the eye if the vision is blurred for a short time after its use.[112]

To be continued

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Ophthalmic Miniature

If I have any reputation in this way (lithotomy) I have earn'd it dearly, for no one ever endured more anxiety and sickness before an operation, yet from the time I began to operate, all uneasiness ceased.

William Cheselden, Surgeon,
Anatomy of the Human Body, 1740, 5th edition.

VASODILATOR THERAPY FOR HEMORRHAGIC GLAUCOMA*

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Hemorrhagic glaucoma is a not uncommon complication of thrombosis of the central retinal vein. Uhthoff estimated[1] that it occurred in 13 percent of the cases, and Foster Moore[2] gives even a higher figure—27.8 percent. Its occurrence must be feared particularly in cases of total obstruction of the venous system; it does not seem to happen in branch obstruction. Miotics control the intraocular pressure only occasionally, and surgical interventions are not only ineffective but fraught with the danger of profuse intraocular hemorrhage. In most cases, only a retrobulbar alcohol injection is able to relieve the patient from unbearable pain, and often the last recourse is an enucleation.

Pathologic examinations show an inflammatory reaction with exudation into the anterior segment which tends to block the filtration angle. A turgescence of the vitreous owing to hemorrhagic products has been assumed by Wood[3] to be responsible for the increased intraocular pressure, and Weinstein[4] has pointed to the presence of acid tissue-metabolites which would have the same effect of causing a swelling of the vitreous. Duke-Elder[5] states that there can be no doubt that a chronic state of stasis and congestion brought about by degenerative and toxic products has much to do with the matter.

With this in mind, the attempt to treat hemorrhagic glaucoma with vasodilation seemed to be a hopeful approach. Any treatment which can avert the desperate last step of enucleation would be of value, even if vision cannot be restored.

Priscoline is one of a group of vasodilators which has attracted attention in the past years and which has proved its value in a series of ocular conditions associated with, or caused by, angiospastic factors. In glaucoma, it has been used with some desirable results. Hoang-Xuan and Bailliart[6] obtained a fall in intraocular pressure in 16 cases with retrobulbar injections, and Fanta[7] affirmed the beneficial effect of this therapy in chronic glaucoma. Although the vascular theory of chronic glaucoma is still a matter of discussion, vasodilation seems to be of value in certain cases.

CASE REPORTS

In hemorrhagic glaucoma, the vascular factor is more obvious, and in the following two cases its importance seems to have been confirmed; vasodilator therapy with retrobulbar injections of Priscoline seems to have averted enucleation by dramatically relieving the almost intractable pain.

CASE 1

A woman, aged 60 years, with severe, badly controlled diabetes and cardiac decompensation, had had occasional episodes of headache and blurred vision in the right eye for two years. Several weeks ago, vision in the right eye became almost completely lost, but she failed to seek help. Two days before the first examination the eye had become very painful and bloodshot.

When first seen, the right eye had no light perception, it was deeply injected, the pupil was dilated and fixed, many newly formed vessels were seen on the iris surface and the fundus showed tortuous veins and large sheets of old and fresh hemorrhages. Tension was 40 mm. Hg (Schiøtz). A diagnosis was made of rubeosis iridis, thrombosis of the central retinal vein, and hemorrhagic glaucoma.

Miotics (pilocarpine, eserine, floropryl) failed to reduce the tension appreciably, but the patient became relatively free from pain. After three weeks, the eye became very red

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and painful again and conservative treatment failed to relieve the tension or the almost unbearable pain.

The patient was admitted to hospital for an enucleation but, before this step was taken, a retrobulbar injection of one cc. of Priscoline solution was administered in the hope that vasodilation might improve circulation and somehow influence the condition. Priscoline was also given by mouth, three tablets daily. The eye became painless within a few hours but the tension was still high. The following day no pain was experienced, and a second injection of Priscoline was administered the next day. The eye remained painless and within the next few days it lost the violent circumciliary injection and became white. The tension was still around 30 mm. Hg, but the patient remained comfortable until her death, some weeks later, from cardiac decompensation.

Case 2

A man, aged 68 years, had lost the vision of the right eye within a couple of days, had seen an eye specialist, and was told that there was a blood clot in the eye and that there was no help for it. Five weeks later the eye became very painful and bloodshot.

When he was first seen, there was a marked ciliary injection present, the pupil was dilated and fixed, vision was reduced to light perception, and the fundus showed large fresh and old hemorrhages with maximally dilated and tortuous veins.

Intraocular pressure was 35 mm. Hg (Schiøtz) and the eye was extremely painful. Pilocarpine for 24 hours and Floropryl for another 24 hours failed to influence the condition. The tension rose to 50 mm. Hg, and a retrobulbar injection of Priscoline (one cc. together with one cc. of procaine) was administered.

Within 10 minutes, the eye was painless —probably an effect of the anesthetic—but it remained painless for two days. Maintenance therapy with Priscoline tablets (one tablet, three times) was prescribed. Another injection of Priscoline was given, this time without procaine. Since then, the eye has remained white and painless. The tension was still above 30 mm. Hg, and vision remained lost.

Discussion

In both cases the beneficial result of retrobulbar Priscoline injections was striking. In the first case, Priscoline was injected without procaine and, in the second one, procaine was added only for the first injection, as the patient was very apprehensive. Most of it was used in the skin and during the advance of the needle into the orbit, and only a small amount was actually deposited in the region of the ciliary ganglion. The gratifying result of the treatment must, therefore, be due to Priscoline. The only pharmacologic effect of this drug is vasodilation and to it the relief from pain and the decongestion must be attributed.

The relief from pain after Priscoline injection, while the intraocular pressure is essentially unchanged, seems to be contradictory. It must be remembered, however, that increased tension itself does not necessarily cause pain as shown by cases of chronic noncongestive glaucoma with very high tension without any pain. The trigeminal pain of glaucoma is the same type as that of iridocyclitis and in both instances it is associated with ciliary congestion. In other words, the pain of congestive glaucoma is caused by the congestion, not the increased intraocular pressure as such.

The relief afforded by Priscoline must be due, therefore, to a relief from the congestion by revitalization of the circulation and the opening up of spastically constricted vessels. This mechanism effects decongestion, but not relief of tension; it alleviates the pain component but not the underlying secondary glaucoma. Priscoline acts upon the periphery of the complex of hemorrhagic glaucoma; it certainly does not influence the

venous occlusion at this late stage, nor is it able to correct the mechanism responsible for the increase of intraocular pressure following this vascular accident. It does, however, relieve the reflex response of the ciliary vessels and symptomatically alleviates the accompanying severe pain.

SUMMARY

In two cases of hemorrhagic glaucoma with intractable pain, retrobulbar injections of Priscoline resulted in complete and lasting relief from pain without normalizing the tension or improving vision.

3 Hopper Street.

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RESTORED VISION BY MEANS OF THE ARTIFICIAL PUPIL

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The first artificial pupil to remain open for a time and to be followed by useful vision was made in 1711. In this year it occurred to Woodhouse, an eye surgeon of London, that he might make an opening in the iris in cases of closed-over pupils so as to admit light and thereby to restore vision.

The route selected by Woodhouse was through the sclera behind the iris. Such a scleral route even today would be the logical site for an opening of this nature if it were not for the ciliary body. It took 81 years of trial and error, however, with failures strewn along the way, to establish the fact that this route, easy as the operation here seemed to be, must inevitably be followed by failure for it showed no regard for the ciliary body (or for surgical cleanliness). In spite of this, many successes from the operation were reported at various times.

Although the early surgeons gave many reasons for lack of success in operations for the creation of artificial pupils, we know now that the chief cause of failure was ignorance of infection as an entity in surgical diseases. During the periods in which these first operations were done, it was considered hazardous to incise the cornea; as a consequence the surgical approach to the formation of new openings in closed-over pupils was, for more than a century, made through the sclera, or even at times through the ciliary body itself. This adherence to a rule laid down by the early surgeons, and the fact that such operations were usually done on eyes in which the crystalline lens had already been pushed back into the vitreous by the operation of couching, almost invariably spelled disaster. If by a fortunate circumstance the operation ended with any degree of vision, this renewed surgical insult to the eye which usually had a lens floating in the vitreous humor almost always ended in glaucoma or uveitis or both with complete loss of vision.

While Woodhouse (1714) and Cheselden (1728) performed operations with a view to creating new pupils, Briggs, another English surgeon and a translator of Scarpa's textbook on the eye, stated that the several operations done at that time were complete failures, and that in reality the first operation by Cheselden's method which gave any semblance of success was done by G. Heuer-

mann and was reported in Copenhagen and in Leipzig in 1756. The technique advocated by Heuermann was to make an opening in the sclera behind the ciliary body after which a long, slender knife was used to pierce the iris, thus entering the anterior chamber, after which it was to be carried across the iris horizontally, dividing the iris fibers, causing them to gape and thereby produce an artificial pupil.

In a book in my collection entitled *Scarpa on the Eyes,* published in 1801, I find examples of four cases of artificial pupils made according to the method of postciliary body puncture for all of which Scarpa claimed success, yet I also have from the pen of his translator the following reference, "Scarpa . . . appears to have relinquished this mode of operating as the newly formed oval pupil in process of time became filiform and completely useless."

In 1792, just nine years before Scarpa's book was published and at a time when the fame of Vienna as a surgical center had already extended throughout the scientific world, Prof. Joseph Beer, operating in K. K. Allgemeines Krankenhaus, Vienna, made, through a corneal section, an opening in the iris, or a so-called new pupil, that did not seal over as all previous openings had done at the hands of other surgeons. The success of Beer in this case was destined to make this type of operation one of the most important in ophthalmic surgery.

In 1873, L. de Wecker in his *Annals de Oculistique* described an operation for an artificial pupil which began with a short incision in the cornea near the limbus which was carried through the iris just above the closed area. Then both blades of the Pince-Ciseaus, now known as the de Wecker's scissors, were inserted one inside and one outside of the opening in the iris, and the iris was divided for a distance of five mm. The scissors, still with one blade inside and the other blade outside the iris, were now carried to the opposite side of the horizontal iris incision where another snip was made in the iris. The lower part of the flap thus formed was now removed, providing a quadrilateral opening in the iris. This operation immediately met with general approval and it is still more or less extensively used.

In this history I have purposely left to the last the operation of Kuhnt which, in my opinion, has been more successful in the hands of a greater number of eye surgeons than any other operation. It is a simple procedure and one easily carried out.

To begin, a von Graefe knife is carried through the cornea and is made to perforate the iris. After the iris is thus penetrated, the knife is pushed back of the iris for six mm. or so and a counter puncture is made in the iris. The section in the cornea, which necessarily includes the iris as well, is now finished. An iris forceps is used to grasp the recently freed iris, a portion of which is withdrawn and cut off.

The section in the Kuhnt operation may be made downward or upward; in certain instances lateral incisions are indicated. Because most of the iridotomies by the Kuhnt method are made at the periphery of the iris, a certain amount of dazzling may be expected by the patient. In 1938, a number of my cases operated by this method were published in my book on the eye and a year later four of them appeared in Spaeth's *Principles and Practices of Ophthalmic Surgery.*

Cases requiring artificially made pupils may usually be grouped into two classes:

First are those in which the pupil, as an aftermath of iritis, has become adherent to the anterior capsule of the lens. Eyes of this type may be benefited only by an iridocapsulotomy accompanied by extraction of the lens. The exception to this is, of course, found in young patients in whom a complete absorption of the lens often takes place after the lens capsule is ruptured.

The second and, in my opinion, the chief reason for making attempts at the formation of artificial pupils may be found in aphakic cases in which the iris has been

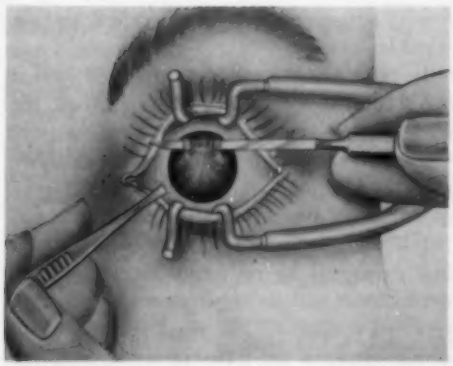

Fig. 1 (Atkinson). The knife has entered at the limbus and (A, fig. 2) has been passed through, and carried behind the iris for six mm. It has again entered the anterior chamber and a counterpuncture has been made in the cornea.

entirely sealed over by any of the numerous reasons for this untoward ending of a cataract operation. This type of case is probably the most formidable of all cases reviewed herein, and one of my chief purposes in writing this paper is to outline a surgical procedure to treat them.

The operation was first done as follows:

Presuming that the subject had a sealed-over pupil of the left eye, a von Graefe knife, cutting blade downward, was inserted through the cornea three mm. from the limbus at the 2-o'clock position (fig. 1). The knife was carried inward, penetrating the iris at the junction of its outer and middle third. The handle of the knife was then depressed and its point was made to re-enter the anterior chamber at a point corresponding to that at which it entered the iris. The tip of the knife was now passed outward through the cornea, emerging three mm. from the limbus at the 10-o'clock position. This section was then carried downward, the knife being given a to-and-fro or sawing motion (fig. 2).

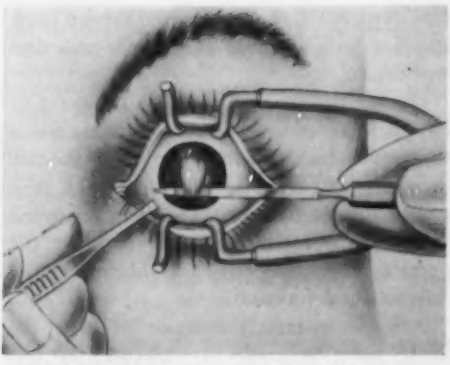

Fig. 3 (Atkinson). The taut iris is about to give way before the cutting edge of the knife.

Soon the taut iris engaged by the knife gave way (fig. 3), its elasticity causing the incision in the iris to gape, thus creating an opening in the iris (fig. 4). This occurred before the corneal section, while being car-

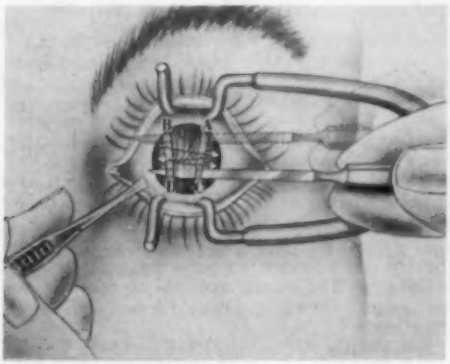

Fig. 2 (Atkinson). The knife has emerged from the anterior chamber at (B) and with a sawing motion has been carried down to (D-C).

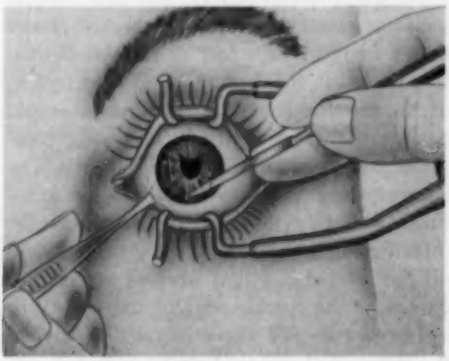

Fig. 4 (Atkinson). The section has been finished in the cornea and iris and the iris flap has retracted leaving a central opening. The knife is being withdrawn.

ried downward, reached beyond the 4-o'clock and 8-o'clock positions. The knife was then withdrawn.

During these first operations the point of the knife entered three or four mm. inside the limbus. Later I found that, since the two incisions converged as they descended they would encroach upon the already limited working space, it was better to enter the point of the knife one mm. internal to the sclerocorneal junction.

After it enters the anterior chamber, the knife point is made to puncture the iris three mm. inside its border. It is then carried behind the iris for a distance of six or eight mm. after which the counterpuncture in the iris is made and the point of the knife again appears in the anterior chamber.

The next step is to make the counterpuncture in the cornea. The site of this should approximate that of the initial corneal puncture.

The operation now proceeds with the surgeon making a corneal section downward without any regard for the iris. The incision is given the same sawing or to-and-fro motion as is employed in making a corneal section for the extraction of cataract. Such a procedure actually cuts the iris instead of dragging it before the knife and thus tearing it.

As the knife descends, the two corneal incisions converge slightly so that they are drawn more to the center of the cornea than they were at the beginning. The direction of the incision is now changed, as it would be in a corneal section which is to be completed five or six mm. from the limbus. The corneal section, however, rarely has to be finished—either the iris will divide as the direction of the section is changed or it will do this as soon as it is pressed against the cornea by the cutting edge of the knife.

If, occasionally the iris fails to divide, the downward section will have to be completed. This is a rare occurrence, however, for the iris, because of its friability, will usually divide before sufficient pressure to finish the lower part of the corneal section is made.

In the event that all has gone well so that the section will not have to be finished, the knife is withdrawn.

Hemorrhage into the anterior chamber may be a serious complication of any type of operation for the creation of an artificial pupil. In this operation, however, though hemorrhage is by no means desirable, it is not of such serious consequence as in other types of operation. The reason is that blood rarely appears until the puncture and the counterpunctures have been made in the iris.

This much of the operation being accomplished, the surgeon then proceeds with his incision in the cornea, and the iris, even if it cannot be seen, is cut, as the cornea is cut, as a matter of course. In some of my cases the margins of the new pupil have fallen forward and adhered to the posterior surface of the cornea. This accident may be righted by promptly freeing the margins of the incision from the obstruction and replacing the flap with a spatula.

If this or any other disappointing occurrence indicates that the operation has not been successful, it may be necessary to repeat the procedure. This should not be done, however, until the eye is again entirely quiet. A second operation, if performed too soon, will almost certainly defeat its purpose.

Case reports

Case 1

O. S., a white man, aged 77 years, was admitted on November 25, 1929, with the history that his left eye, after operation for mature cataract, had developed an iritis that did not respond to the atropine therapy of the period. The eye soon became adherent in the corneal incision. After a stormy convalescence the eye became quiet, leaving the iris much drawn up with the pupil entirely sealed over. The cornea contained no opacities except in and extending downward two mm. below the cicatrix.

Examination. Vision was: R.E., no light perception. L.E., ability to distinguish a light glow in a dark room and to see the shadow of a hand passing between the eye and the light. The iris was entirely occluded and sealed over by exudates. Both

eyes were apparently quiet. There was no pericorneal injection in either eye.

This patient, although somewhat senile, was strong for his age and apparently in good health. Despite his mental aberration, he was co-operative.

Operation. A modified Kuhnt operation of the left eye was decided upon. A von Graefe knife was used to enter the anterior chamber cutting edge downward on the temporal side at the 3-o'clock position. After penetrating the iris, the knife was passed under the iris for six mm. The handle of the knife was then elevated and its tip was carried through the iris at the nasal side; again it appeared in the anterior chamber. From here, the knife tip was again carried through the cornea at the nasal side and a point corresponding to the site of the internal puncture made on the temporal side. At this point in the operation, the object was to divide by a downward see-sawing motion, both cornea and iris at the same time, and to complete this incision at a point extending transversely across the cornea from the 4:30-o'clock to 7:30-o'clock position. It was further intended to grasp a piece of iris with slender forceps and draw the grasped portion sufficiently forward to be reached by iris scissors and snipped off, a procedure which I had adopted in former cases and which had usually left satisfactory openings in the iris.

As I proceeded downward with this incision, still with the intent of doing a modified Kuhnt operation, and before I reached an imaginary transverse line from the 4:30 to 7:30-o'clock position, I was startled to see that the iris had been cut through, and by its own elasticity had retracted sufficiently to provide, an opening slightly below the center of the iris. Because of the fact that this accidentally formed opening appeared to be of sufficient size to admit light, I withdrew the von Graefe knife, leaving the corneal section unfinished. There was no bleeding from the iris incision and the patient could distinguish fingers passed before the eye. A drop of one-percent solution of atropine was instilled, the eye was covered, and patient was removed to his room.

On November 28th, when the eye was dressed, there was a good opening in the iris slightly below the center. The patient saw fingers well and the eye revealed no untoward symptoms. He was discharged from the hospital on December 4th. By December 19th, when seen in the office, the wound had healed. There were no complication.

On January 28, 1930, the patient was refracted and given a plus 10 lens over the left eye. He came to the office periodically for four years during which time he retained useful vision in the left eye. His death occurred in 1934.

CASE 2

W. J. T., a white rancher, aged 59 years, had only light perception in either eye following an explosion of glass.

Operation. When he was admitted on December 2, 1941, it was my plan to duplicate the operative steps described in Case 1. This plan was carried out on the right eye with the following exceptions:

In order to have the opening of the iridotomy situated slightly higher than in Case 1, a temporal puncture was made with the von Graefe knife, cutting edge downward, and a nasal counterpuncture was made at the 2- to 10-o'clock position. This provided more room for a larger central opening. As the joint incision in the cornea and iris was carried downward, the iris divided and retracted nearer the center than in Case 1, thus leaving a freer opening. The procedure was not followed by blood in the anterior chamber.

Before leaving the operating room the patient could see a hand passed before the eye. A one-percent solution of atropine was instilled, the eye was dressed and the patient was removed to his room. Convalescence was uneventful and the patient was discharged from the hospital in good condition.

On December 10th, when the patient was seen in the office, the wound had healed. There was no complication. On August 31, 1942, the pupil was still open, as it was on September 30th and November 27th. This patient returned at intervals. When last seen the central opening was clear and showed no dimunition in size and his vision of 20/400 enabled him to get about comfortably at home.

CASE 3

Mrs. F. W., a white housewife, aged 65 years, was admitted on January 22, 1946, with the history that she had had a cataract extraction of the right eye a number of years before. Because of post-operative inflammation, the pupil became sealed over with exudates and there was no pupillary opening.

Examination. Vision was light perception in either eye. Physical examination was essentially negative.

Operation. In this case, in order to provide more room for a central iridotomy, the point of the von Graefe knife, cutting edge downward entered two mm. external to the limbus. This was done because of the tendency, noted in Cases 1 and 2, of the corneal incision to assume a triangular pattern, base up and apex down. With the extra four mm. gained by this manuever, the apex of the triangle would reach a point slightly lower on the cornea. Otherwise the technique of the operation was identical with that in Cases 1 and 2.

After an uneventful convalescence, the patient was discharged from the hospital on February 6th. When last seen on December 2, 1946, the pupil was still open and she had useful vision of 20/100.

CASE 4

Mrs. S. S. S., a white housewife, aged 67 years, was admitted on January 28, 1947, with the history of a secondary capsular cataract operation on the left eye about a year earlier. The pupil was sealed over by exudates and obliterated.

Examination. Vision was: R.E., blind; L.E., fingers at two feet.

Operation. As the knife descended, the two corneal incisions were made to converge slightly so that they were drawn more to the center of the

cornea than at the beginning. The direction of the incision was now changed, as it would be in a corneal section which is to be completed five or six mm. from the limbus. (In my hands, this is the approved and final technique for this operation.)

The patient had an uneventful convalescence and was discharged from the hospital in good condition on February 7th. When she came to the office on April 16th, the operated eye was quiet. By June 2nd a plus 13D. sph. was prescribed as a temporary lens for the left eye. She returned on October 20, 1948, and was given a permanent lens of plus 14.25D. sph. with which she could read 20/20.

She made periodic visits to my office until her death in 1950. At the last visit on October 20, 1950, she was much debilitated and vision was reduced somewhat but the pupil was still open.

Case 5

Mrs. T. E. M., a white housewife, aged 69 years, was admitted on March 1, 1949, with the history of a cataract extraction on the left eye, October 4, 1948. She later developed a postoperative iritis and the iris became matted together, leaving no pupil.

Operation. The now standard operation for central iridotomy, as described in Cases 1, 2, 3, and 4, was performed. Although, after operation, the patient complained of pain of the left side, examination, including X-ray studies of the chest, revealed no pathologic conditions. She was discharged March 10, 1949. Her previous prescription: R.E., +11.0D. sph. ⌒ +2.0D. cyl. ax. 180°; L.E., +11.OD. sph. ⌒ +2.0D. cyl. ax. 180° gave useful vision in both eyes.

Summary

An artificial pupil by surgery may relieve cases in which opacity of the cornea obscures the pupil but in which areas of peripherally clear cornea remain; cases in which the pupil is drawn toward the periphery or in which there are synechia between the iris and the cornea. It is also indicated in aphakia with sealed-over pupils.

Obviously the most favorable site for an artificial pupil is as near to the center of the iris as possible. A new pupil at the periphery, as was first suggested by Fuchs, may cause "dazzling," or indistinctness of vision due to refraction of light through the circumference of the cornea and the margins of the lens.

An operation, new to many, for correction of sealed-over pupil following cataract extraction is described and the results to be expected from the method are outlined.

This in my hands has been the simplest, least traumatic, and most effective of the many operations I have tried for producing a central opening in the sealed-over pupil.

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Ophthalmic Miniature

But for subtilizing the visible spirit and for sharpening the vision it behooves one to eat the flesh of birds of prey, such as hawks and falcons and owls, as well as the flesh of serpents.

Ugo Benzi, 1376-1439 *Consilium* 24

(Lockwood, *Ugo Benzi*, University of Chicago 1951, page 145)

AIR INJECTION IN THE TREATMENT OF TRAUMATIC HYPHEMA

JOHN M. WILSON, M.D., THOMAS P. MCKEE, M.D., E. MALCOLM CAMPBELL, M.D., AND GEORGE E. MILLER, M.D.
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The incidence of traumatic hyphema occurring in nonperforating injuries to the eye is extremely common. We have treated 36 cases of this condition during the past two and one-half years. While nothing can be done to prevent such complications as iridodialysis, dislocation of the lens, traumatic cataract, rupture of the choroid, or detachment of the retina due to severe trauma at the time of the injury, an attempt should be made to prevent secondary hemorrhage into the anterior chamber with its disastrous after-effect of secondary glaucoma and blood-staining of the cornea.

All ophthalmologists have seen patients with a slight traumatic hyphema that is followed in several days by a severe secondary hemorrhage. This secondary hemorrhage is always much more severe than the primary one and usually fills the anterior chamber and causes severe secondary glaucoma.

We have injected air into the anterior chamber in each of these 36 cases in an effort to prevent or to control secondary hemorrhage.

Our rational for this treatment is that it would be impossible for the anterior chamber to be completely filled with blood if an air bubble were present. The larger the air bubble present, the less blood could be present, and the air would protect the cornea from coming into contact with the blood and thus prevent blood-staining of the cornea. In the 27 cases that had air injected before a secondary hemorrhage developed, only two had a secondary hemorrhage. In the remaining nine cases of this series, the patients were first seen by us after secondary hyphema had developed. It appears that air not only controls the secondary hemorrhage, but also prevents it.

The cause of secondary hemorrhage from the iris following contusion is not understood. It certainly occurs more frequently and more severely than following the cutting of iris vessels during operation, as in an iridectomy. One factor that may cause such severe bleeding from ruptured blood vessels is hypotony following contusion of the globe. The presence of air in the anterior chamber may increase the intraocular pressure enough to correct this hypotony and thus prevent secondary hemorrhage. Also, since air is compressible and distensible, its presence may prevent large fluctuation in the intraocular pressure.

DAY OF SECONDARY HEMORRHAGE	
Second day	4
Third day	3
Fourth day	3
Fifth day	1
Total	11

This is in agreement with the findings of Thygeson and Beard.[1] They reported on 13 cases of secondary hemorrhage and 11 of these occurred on the second and third days, and none after the fifth day. Rychener's[2] findings were also in agreement with this.

Since the secondary hemorrhage occurs between the second and fifth days, the prognosis for the eye improves markedly if this period of time can be safely passed. Air is absorbed from the anterior chamber from within two to four days. If absorption takes place before the safe period has passed, we have often re-injected air through the same corneal tract.

TECHNIQUE OF AIR INJECTION

A small slanting incision is made through the cornea about one mm. within the limbus with a Wheeler knife. A 27-gauge needle is inserted and air is injected into the anterior chamber. This is a very simple and safe procedure, and can be performed under

local anesthesia, even in children. If the child is not co-operative, a short general anesthesia is necessary.

In the two cases of secondary hemorrhage that occurred after air had been injected preliminarily, there was air present in the anterior chamber, and it did not become completely filled with blood. In each of these cases, more air was injected and the hyphema absorbed without further bleeding.

In the other nine cases, the secondary hemorrhage had already occurred before these patients were referred to us. The hemorrhage in all these cases was massive and completely filled the anterior chamber, and severe glaucoma was present. In these cases, we removed the blood clot from the anterior chamber.

Two of these patients had slight blood-staining of the cornea, but the cornea cleared rapidly after the blood was removed, and they had a good visual result. Two patients had an elevated intraocular pressure for several weeks which was controlled by a paracentesis and epinephrine bitartrate.

Technique of removing a blood clot

A small tract incision is made in the cornea with a Wheeler knife, near the limbus at the 3- or 9-o'clock position. This tract is used at the end of operation to inject air into the anterior chamber. A small corneal incision is made at the 12-o'clock position with a cataract knife. The incision is made very short because a long, deep incision may injure the lens or the iris due to the blood in the chamber hindering the operator's vision. The incision is then enlarged with scissors. A fairly large incision causes no further complications and facilitates removal of the clot.

The blood clot is grasped with the capsule forceps and removed. Often the clot can be removed as a cast of the anterior chamber. Any remaining blood is irrigated out and the corneal incision is tightly closed with four or five 6-0 silk corneal sutures. A needle is then inserted into the anterior chamber through the previously placed tract incision and the anterior chamber is filled with air. This controls any further bleeding.

Age incidence

Twenty-nine of the patients were children and only seven were adults over 16 years of age. The major causative agents were BB shots or thrown stones and balls. Of course, children are more prone to this type of trauma and we do not believe that any definite conclusion can be drawn that children are more prone to hemorrhage following eye contusions.

Associated ocular lesions

Severe iridodialysis	5
Traumatic cataract	5
Macular lesion	4
Detachment of the retina	1
Blood-staining of cornea (slight and cleared completely)	2
Total	17

In this series of 36 cases, the visual results were good except in those cases where associated lesions produced faulty vision. There were no cases of visual impairment due directly to the hyphema.

Routine treatment

These patients are admitted to the hospital and air is injected into the anterior chamber. They are placed on complete bedrest for four or five days. Only the injured eye is patched. Bilateral bandage of the eye probably would be of value but we feel that the increased restlessness this would cause, particularly in children, would outweigh the advantage. We use no local medication in the eye except atropine after the fifth day if there are signs of iritis.

There is disagreement among ophthalmologists as to the use of miotics and mydriatics.

Thygeson and Beard[1] advocate homatropine, while Rychener[2] advocates pilocarpine. We give calcium, vitamin C, and vitamin K systemically. It is doubtful if any antihemorrhagic drugs are of any value in pre-

venting secondary hemorrhage, but they do no harm and are given empirically. Sedatives, such as phenobarbital, are administered to keep the patient quiet.

Discussion

We have been aware of the extreme seriousness of traumatic hyphema for several years. Blood-staining of the cornea is a real catastrophe. Rychener[2] reported nine cases that never recovered useful vision. Thygeson and Beard's[1] three cases also obtained very poor visual results.

Our attempts at treatment or prevention of secondary hemorrhage in these cases had been very discouraging before starting on our present regime of treatment. Of our 27 cases in which air was injected soon after the accident, only two, or seven percent, developed a secondary hemorrhage and these two were not severe.

It is difficult to evaluate a form of treatment for this condition because many primary hyphemas absorb without any treatment. Since we had nine cases referred to us after secondary hemorrhage had developed, there must have been many more that never developed secondary hyphema. However, in our experience, only seven percent of cases of secondary hemorrhage is a great improvement.

Thygeson and Beard[1] reported 13 out of 34 cases, or 38 percent but, there again, some of their patients had already developed secondary hemorrhage when first seen by them.

Of the nine cases of severe secondary hemorrhage that were operated on for evacuation of the anterior chamber, we feel that the air injected into the anterior chamber prevented further bleeding. We believe that these cases should be operated upon early, before blood-staining of the cornea occurs and before severe iritis develops.

Summary

1. Thirty-six cases of traumatic hyphema due to contusion are discussed.

2. Air injection into the anterior chamber is suggested as a treatment for preventing and controlling secondary hemorrhage.

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OPHTHALMOLOGY IN THE UNION OF SOUTH AFRICA

The report of a recent visit

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During the sessions in Scotland preceding the 1950 International Ophthalmological Congress in London, it was our good fortune to meet two of the important ophthalmologists of the Union of South Africa, the learned Dr. Meyer and the dynamic Dr. Jokl. They sold their country and we began to plan a trip to see them, their confreres, some of their institutions, the marvels of their large thriving cities, the gorgeous country so filled with historical associations, and the Kruger National Park.

The journey to the distant land was begun on February 1, 1953, when by T.W.A. we went to Boston, Gander and the Azores to Lisbon, where we stayed overnight to revisit some of its notable places, especially Cintra with its visible record of many invasions by Crusaders and Moors.

Twenty-four hours after arrival we left by

Fig. 1 (Bedell). General Hospital (Main Block), Johannesburg.

Pan-American, flying close to the Canary Islands with their innumerable volcanic cones, and then over the Sahara of endless sand, oases, and rocks. Stops were made at Dakker, Gold Coast, Roberts Field, and Leopoldville. When south of the equator, the summer heat was oppressive after the zero weather of New York.

We arrived at Johannesburg at 9:40 p.m. the second day out of Lisbon and were met at the airport by the competent Dr. Jokl who processed us through customs, and to a comfortable hotel.

Early the next morning he took us about that fabulous city of gold, which is about 6,000 feet high and has 900,000 inhabitants, ultramodern skyscrapers, some of which are occupied exclusively by physicians and dentists, and a beautiful library with a complete photographic history of the city from the date of its foundation. We visited the large city hall and the huge railway station which is already inadequate.

We soon appreciated that four things were dominant, the skyscrapers, the homes, the trees, and the yellow hills of crushed rock

Fig. 2 (Bedell). General Hospital (Department for Eye, Ear, Nose, and Throat), Johannesburg.

from the mines, locally called the dumps. Together they make a unique community where more than 40,000 Europeans and 280,000 natives are connected with the mines.

That evening I spoke before the Johannesburg Branch of the South African Ophthalmological Society at the Medical House. The president, Dr. Staz, presided and the efficient secretary was Dr. Hamelberg. Many general practitioners attended. For about three hours fundus photographs were demonstrated and discussed.

On the next night I was a guest at the annual banquet of the Southern Transvaal Branch of the South African Medical Association. Dr. T. Schneider presided with grace and a charm that is rarely equalled. The evening was noteworthy. I sat next to the Honorable H. Miller, Mayor of Johannesburg, and we talked about the contrast between his growing country and the United States. It was a rare privilege to have a chance to visit with him and learn much about the great city which he so capably directs.

The speeches were in a serious vein. Dr. Orenstein referred to the condition of the medical profession and Prof. F. S. Oosthuizen was particularly enlightening in his review of present conditions. It was an opportunity to meet the leaders of the medical profession and most of the professors and teachers of the universities.

In Johannesburg almost everything medical revolves around the General Hospital, a large modern institution with 1,541 beds for Europeans and 1,810 for non-Europeans. The average daily census of in-patients during the last year was 2,793. The number of casualties and out-patients during the same time exceeded one million.

The ophthalmological department is in a wing close to the main block. It contains 40 beds all for Europeans. It is always full and there is a long waiting list for operative cases. The number of cases examined during 1952 was nearly a thousand, 816 operations were performed, and 5,341 out-patients were treated.

The most important hospital for non-Europeans is the Baragwanath about 10 miles from the center of the city. It was opened in 1944 and has attendants in all specialties,

Fig. 3 (Bedell). Baragwanath Native Hospital, Johannesburg.

35 are full time, and in minor specialties, eight part time, with 25 registrars and trainees and 53 housemen. During the year nearly 30,000 persons were treated as in-patients and 60,000 in the dispensary, while the casualty department cared for 90,000. Altogether more than 10,000 operations were performed. A marvelous reservoir of clinical medicine; a fertile field for ophthalmological research and practice.

In the eye department there are 58 beds and these are always occupied. In looking over the list of the operations for the year we found that they were similar to those performed in a comparable United States hospital.

Johannesburg is the center of the gold mining district of the Transvaal which ex-

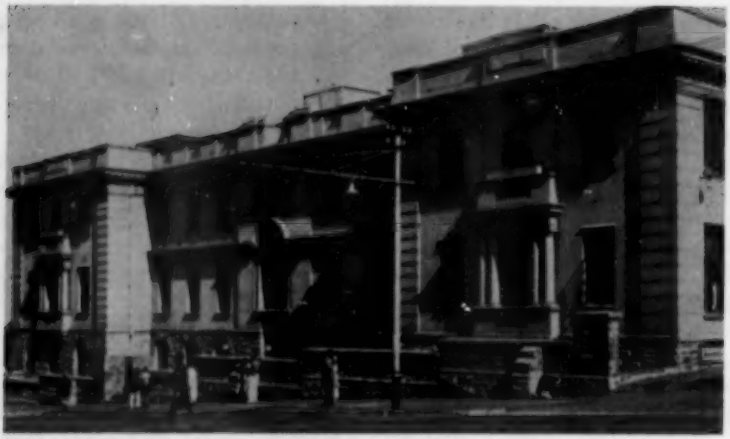

Fig. 4 (Bedell). Witwaterstrand University Medical School, Johannesburg.

tends over 20 miles to the east and west of the city. Most of the mines have their own hospitals with full-time medical men who treat the diseases of the miners. Accidents are sent to the special hospital of the Witwatersrand Labor Association where 2,000 cases were seen last year with 600 operations.

The University of the Witwatersrand was founded in 1920 and its Medical School was grafted on to the General Hospital. Many of the physicians and surgeons then in charge were made teachers. This close connection between Medical School and General Hospital provides the teaching material. The chief of the ophthalmological department is Dr. M. Franks. The seniors are Dr. I. Marais, Dr. L. Staz, and Dr. H. Kaye. There are several assistants.

A course in ophthalmology is part of the curriculum and is compulsory for the fifth-year students.

In October, 1952, a new hospital was opened, St. Johns, a foundation of the Order of St. Johns on the pattern of the similar institution in Jerusalem. At the present time there are 28 beds for non-Europeans. The hospital is staffed by part-time ophthalmologists from Johannesburg, in addition there is a registrar in residence.

St. Johns has been approved by the South African Medical Council and the University of Witwatersrand for the purpose of training doctors in the specialty of ophthalmology. This is the only institution of its kind in the Union.

The Institute for Medical Research is

Fig. 5 (Bedell). St. John's Hospital (front view), Johannesburg.

housed in a large, imposing building on Hospital Hill close to the General Hospital. Under the directorship of Dr. E. H. Cluver all branches of medicine and the associated sciences are studied. It deals with many problems specific to South Africa and generously contributes to the raising and maintenance of the high standard of medical work in the Union. It has branches in several centers in the Union, where a great amount of scientific research is carried on by members of the staff. The routine division provides the laboratory work necessary for the daily needs of the general practitioner and specialist.

Several smaller hospitals provide services for the communities surrounding Johannesburg. These are in Krugersdorp, Roodepoort, Germiston, Boksburg, and the Far East Rand Hospital. The hospital in Edenvale in the northeastern section of the city is a new foundation to take the overflow from the Johannesburg Hospital. All of these have an eye department both for Europeans and non-Europeans with one or two part-time ophthalmic surgeons.

The Pretoria Medical School added to the university in 1942 is closely connected with the Pretoria Hospital which caters to both Europeans and non-Europeans. The number of in-patients during the last year exceeded 30,000 with well over 100,000 out-patients. All free or part-paying patients are under the care of the clinical teachers. The head of the department of ophthalmology is Dr. J. C. Kriek. There are limited facilities for postgraduate training.

In Vereeniging, 30 miles south of Johannesburg, the ophthalmologist in charge of the eye department of the hospital looks after the employees in the coal mines and steel plant.

Fig. 6 (Bedell). Institute for Medical Research, Johannesburg.

There are several smaller hospitals in the Transvaal province, but they have no special facilities for eye patients. There is, however, a large Missionary Hospital in Elim, not far from Louis Trichardt, in the Northern Transvaal, which has an ophthalmological department with a trained ophthalmologist—the only one between Pretoria in the South and Bulowayo in Rhodesia—a distance of nearly 600 miles.

Only non-Europeans are trained in the medical school in Durban, Natal; the teachers are European. The college hospital is large. The several small hospitals in the province have no special equipment for eye work.

The Orange Free State headquarters for medical services is in the capital, Bloem-

Fig. 7 (Bedell). Groote Schuur Hospital, Cape Town.

fontein, where the hospital has an eye department.

In the Native Protectorates there are no trained eye specialists. Some times ophthalmologists from the Union examine cases and operate. Usually those who cannot be treated by the local doctors are referred to the nearest center in the Union.

Several eye epecialists in Bulowayo and Salisbury treat both the whites and the natives in Southern Rhodesia. There is no eye specialist in Northern Rhodesia, but the region of the Copper Belt is visited regularly by doctors from Southern Rhodesia and urgent cases are brought to them.

The Protectorate of Nyasaland has no eye specialist.

No report of our Johannesburg sojourn would be complete without mentioning the delightful luncheon at the Country Club where Dr. R. C. J. and Mrs. Meyer entertained us on a glorious, sunny day such as we have in June in some parts of the Eastern United States. The food was delicious, the outlook unsurpassingly fine as we gazed over the well-kept lawns to the magnificent trees, shrubs, and flowers—the most unusual was the Pride of India, a tree completely covered with pink blossoms. Later on we went to the Meyer home which is situated on a hill overlooking the city. There we had an enjoyable tea and spent a very pleasant afternoon.

Our last evening in the city was at the beautiful Jokl home high above the city. The surroundings were delightful, the food and companionship rarely equalled.

The Sunday morning preceding our departure for Cape Town was spent on a mine compound, where we saw one of the famous mine dances. Hundreds of physically fit and remarkably happy natives performed their tribal dances for the sheer joy of motion. These demonstrations are not war dances but simply the expression of unrivaled rhythmic grace. No visitor should miss them and no physician has ever seen so many beautiful specimens of mankind perform with such precision and grace.

That afternoon we flew to Cape Town, about 1,000 miles southwest of Johannesburg. We were met at the airport by the cordial Dr. Townsend and Dr. deKock and taken to a new hotel on the ocean front.

The next night the ophthalmologists gave me a dinner at the Kelvin Grove, a delightful country club; the meal was far above average and the companionship most enjoyable. There were no speeches, but afterward we adjourned to a comfortable lounge where for more than two hours I answered questions. These embraced not only the present trends of ophthalmological practice in the

United States but also many regarding the country at large with an occasional reference to the political situation.

The following evening in the amphitheater of the Groote Schuur Hospital a large, interested, and alert audience paid strict attention to the photographs which were expertly projected by Dr. Harold Hofmeyr. The discussions were lively and revealed trained, erudite ophthalmologists. It was a most memorable occasion.

Cape Town is a beautiful city and the university is most admirably placed with a prominent mountain, the Devils Peak, abruptly rising in the background. It has one of the finest locations in the world. The medical school is commodious, modern, and efficiently managed. The Groote Schuur Hospital, where the clinical teaching is done, is a new 1,000-bed institution, well equipped and utilized to the fullest extent.

At Groote Schuur there are 50 beds in the eye department, equally divided between Europeans and non-Europeans. The out-patient department functions every morning except Sunday and last year there were 16,000 patients; a wealth of clinical material.

There are three firms in Groote Schuur, each responsible for two days a week with undergraduate clinical demonstrations. The part-time heads are: Dr. Townsend, Dr. deKock, and Dr. Kay. Dr. Townsend is, in addition, head of the department and lecturer in ophthalomology at the university. There are two part-time assistant surgeons attached to each firm—Dr. Appleton, Dr. Louw, Dr. Ferreira, Dr. van Selm, Dr. Haarburger, Dr. Abel, two full-time registrars and two house surgeons.

In Cape Town there are no organized post-graduate courses in ophthalmology, but two full-time registrar posts are recognized by the medical council as suitable for trainees seeking registration as specialists. One post-graduate student is permitted to study ophthalmology at Groote Schuur and this is also recognized for specialist registration.

There are ophthalmic clinics at the smaller hospitals, but, only at Groote Schuur are beds set aside for eye cases. There are no special nursing homes for eye patients and only two or three even accept them.

The Ophthalmological Society of South Africa, a group within the Medical Association of South Africa, holds its meetings in conjunction with the annual South African Medical Congress, which is held in rotation at Johannesburg, Cape Town, Durban, Port Elizabeth, Pretoria, and East London.

The current president is Dr. J. K. deKock, Cape Town; the vice-president, Dr. R. L. H. Townsend, Cape Town; Dr. Hofmeyr, Pretoria; the secretary, Dr. J. G. Louw, Cape Town; members of the council, Dr. P. H. Boshoff, Johannesburg; Dr. L. Staz, Johannesburg; and Dr. P. R. Wentzel, Port Elizabeth.

In both Johannesburg and Cape Town there are local groups which meet four or more times a year. Ophthalmologists have played a prominent part in the affairs of the Medical Association of South Africa. Dr.

Fig. 8 (Bedell). University of Cape Town Medical School Buildings.

Fig. 9 (Bedell). Group of members of the Ophthalmological Society of South Africa. (Front row—left to right) J. Van Selm, J. K. deKock, E. Steinitz, J. C. Heerema, Dr. Rubidge, E. Franks, E. A. Donegan, A. W. Sichel. (Top row—left to right) K. Cunningham, J. G. Louw, B. Kay, L. Staz, J. G. Scott, P. Boshoff, M. Fine, R. L. H. Townsend, R. C. J. Meyer, A. B. W. Ferreira.

A. W. Sichel of Cape Town was one of its illustrious presidents.

The National Council for the Blind is active in the prevention of blindness. It has organized various surveys and drawn attention to the need for ophthalmic treatment. The first mobile ophthalmic unit has been placed in service. A large percentage of the eye diseases are of sociologic origin, due to overcrowding, malnutrition, and ignorance.

The medical libraries put aside a small amount for the specialties, but in some cities the ophthalmologic staffs purchase the more important works of reference.

General color photography is being introduced, but no satisfactory fundus pictures have been made. It is frankly admitted that there is room for improvement in the study of the pathology of the eye.

While in Cape Town we had the rare opportunity of going to Parliament as guests of the very active member Dr. B. Friedman. There we had some of the finest food and the best service in the Union. You may recall that the spring elections were in offing; the debates were heated and the arguments well stated.

Cape Town is an entrancing city with Table Mountain as a background to a scene of unforgettable beauty. We saw the old Dutch homes and especially the Kooperman DeWitt which is kept as a museum. It is a fine example of a 300-year-old Dutch house. The furniture is original and the place kept in spotless Dutch fashion.

The view from our hotel was superb and we could see the mountain peaks, locally known as the Twelve Apostles. We drove around the cape and took the Garden Route trip. Some of the hotels along the shore were the best we found anywhere; all were comfortable.

We admired the country of cultivated vineyards, orchards, fields, and forests with here and there an old Dutch home preserved as a museum with unusual window arrangements and a typical kitchen as well as slave quarters. If this were a travel talk, I could dwell upon the glory of the mountains, the thrill of the shore lines, the exhilaration of

standing on the Cape of Good Hope seeing the Indian and Atlantic oceans merge, and the fog drift in at midday as it has done for years, making the ocean journey very hazardous.

The scene was conducive to dreaming of the tragedy of the sea and the romances of the survivors, but the mood was broken by reading the signs in the Cape Reservation, "Beware of the baboons." We rode along the Indian ocean shore through many small and large towns all of which have played their part in the development of South Africa, where the problems of race and the intricacies of government are many.

When we returned to Cape Town before going north, Dr. and Mrs. Townsend entertained us at the oldest club in South Africa, the Civil Service Club. There we had a delightful visit wth them and Dr. and Mrs. Sichel.

There are four medical schools in the Union: the University of Cape Town, University of Witwatersrand, the University of Pretoria, and the University of Durban.

The Medical Council, a statutory body endowed with disciplinary powers, is responsible for keeping a register of qualified medical practitioners and of laying down and enforcing standards of medical education. It also keeps a Specialist Register.

To qualify for the degree of M.B. Ch.B. takes six years. After this, the graduate is compelled by law to do a minimum of one year as an intern before he may register or practice. At present a graduate may not be admitted to the Specialist Register until he has been qualified at least six years. In general these six years must include two years of general practice, three years of ophthalmological experience in posts of registrar status in the eye department of a teaching hospital, and one year of medical experience in a post of similar status. There are various exceptions and modifications to these requirements.

Every university is associated with a large

Fig. 10 (Bedell). University of Cape Town with Devils Peak and part of Table Mountain in the background.

teaching hospital which is the joint responsibility of the university and the administration of the Province. Each has its eye department and is a center for opththalmological work and teaching.

My most sincere thanks are given to Dr. Jokl who planned our trip, arranged for the meetings, and supplied much of the technical data for this report. He and Mrs. Jokl took us through Kruger National Park where we saw many of the wild animals of Africa.

My deep appreciation is also recorded for Dr. and Mrs. Meyer's care. I am especially indebted to Dr. Townsend and Dr. deKock for their report regarding Cape Town. Without their help and the friendly interest and advice of many others we would have been unable to appreciate the high standard and sterling character of the ophthalmologists of the Union, the heavenly peace of the mountains and the restful waves of the oceans.

It is our hope that many of them will come to the International Meeting in 1954. An invitation was extended on behalf of Dr. Bernard Samuels, president of forthcoming congress, Dr. A. A. Eggston, president of the Medical Society of the State of New York, and Dr. H. E. Hilleboe, commissioner—New York State Department of Health.

344 State Street.

CLINICAL PATHOLOGIC CONFERENCE

From the Laboratory of
PARKER HEATH, M.D.
Boston, Massachusetts

CASE E52-2

HISTORY

The patient, a 64-year-old woman, was struck in the left eye by a stone when very young. She considered her subsequent vision to be good in this eye, and has been free from ocular symptoms for many years. Thirteen years before this visit her eyes were examined for glasses and the left eye was found to be blind. In the past 12 years, she has had periodic attacks of congestion and redness of the left eye.

EXAMINATION

The right eye was essentially normal in all respects. The left eye was blind; a small ovoid elevated subconjunctival, fixed, deeply pigmented mass was seen arising from the superior mesial aspect of the sclera, four or five mm. from the limbus.

The cornea showed scarring, vascularization, and even denser opacification below. Some hemorrhage was visible in the anterior chamber. Other details could not be visualized because of scarring and cloudy media. Intraocular pressure, was 55 mm. Hg (Schiøtz).

Transillumination of the left globe suggested that there was less light transmission but this appraisal was not definite because, again, the corneal scarring interfered.

TREATMENT

Enucleation of this blind irritable eye was advised and accepted. No complications were encountered at the time of surgery.

DIFFERENTIAL DIAGNOSIS

*Discussion by Dr. Sumner Liebman.** The patient had a definite history of an ocular injury which was kept in mind for many years and consequently was probably of some significance. Blindness was discovered by accident 13 years before this examination and could have existed for an indefinite period be-

* Assistant Surgeon in Ophthalmology, Massachusetts Eye and Ear Infirmary.

fore discovery. The onset was very gradual and painless. Something brought her to the doctor, however, and her history for the past 12 years describes periodic attacks of redness and congestion.

The recent episode was one of painful glaucoma with hyphema behind a scarred, vascularized, nearly opaque cornea. The small pigmented mass near the limbus could explain the glaucoma and the hyphema but less satisfactorily the corneal changes. The explanation, of course, is that the black mass is a malignant melanoma arising from the choroid or ciliary body and perforating near the limbus. As is often the case transillumination gave inconclusive results.

The old trauma could have caused separation of the retina, perhaps dislocated lens, and uveitis, which could explain the periodic attacks of redness and congestion. The pigmented mass is still unexplained, however. It is described as elevated and fixed *under* the conjunctiva. I think a tumor could easily, perhaps too easily, explain the recent clinical episode—apart from the corneal changes. The latter could be related to the glaucoma. The old state of blindness has a long list of possible causative factors. Retinal disease and long-standing glaucoma head the list. I am unable to discriminate.

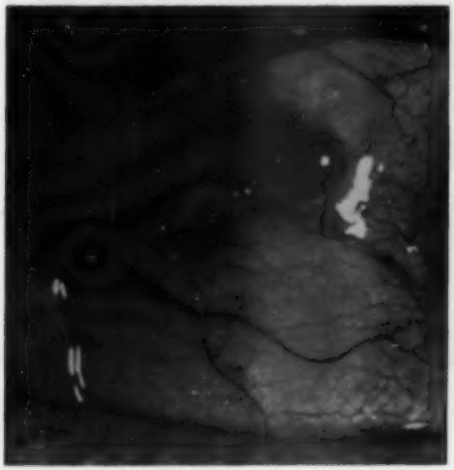

Fig. 1 (Heath). Small scleral staphyloma.

Fig. 2 (Heath). Whole globe, showing dislocated lens and glaucomatous cupping.

Diagnoses

Clinical diagnosis. Old scarred, vascularized cornea; pigmented tumor of the ciliary body with perforation; secondary glaucoma; blind painful eye.

Dr. Liebman's diagnosis. Old retinal disease; glaucoma secondary to uveitis and possible intraocular tumor with perforation; hyphema and corneal scarring.

Pathologic diagnosis. Small staphyloma of the sclera (figs. 1 and 3); dislocated cataractous lens (fig. 2); recurrent uveitis; advanced chorioretinitis with atrophy and fibrosis; late stage of atrophy of the iris, ciliary body, and choroid (fig. 3). Advanced cystic and fatty degeneration of the retina; late secondary glaucoma; glaucomatous and cavernous atrophy of the optic nerve; small abscess of the optic nerve; hyphema; bullous and band keratopathy; extensive vascularized scarring of the cornea.

Comment

Dr. Parker Heath. The scleral pigmented mass represented a sort of "black" herring. As can be seen from Figure 1, the elevated subconjunctival mass looks, on casual inspection, like an early extrabulbar extension. However, if a probe had been applied to it,

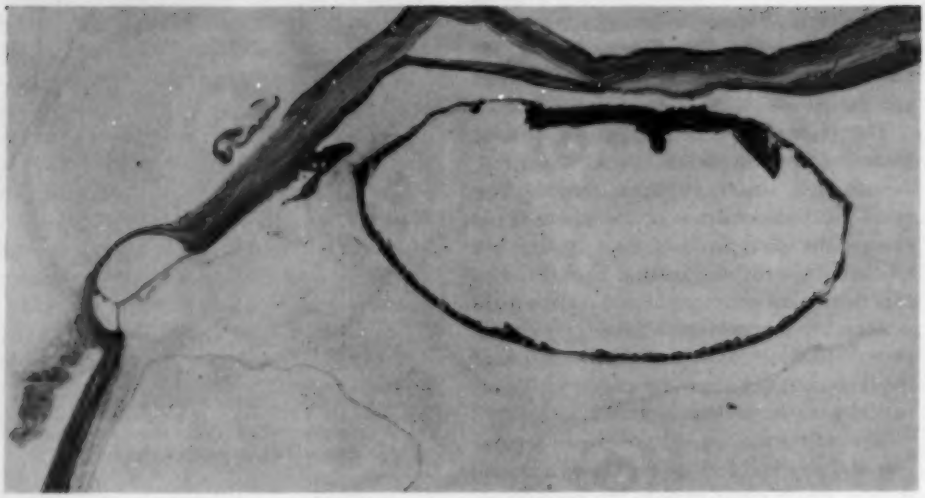

Fig. 3 (Heath). Scleral staphyloma containing pigment epithelium of retina; atrophy of iris and ciliary body; anterior synechia.

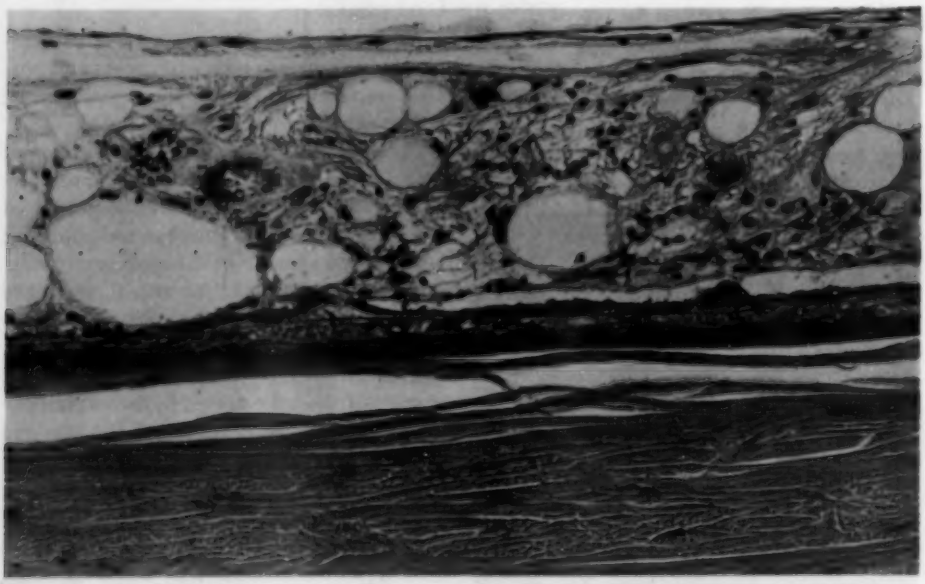

Fig. 4 (Heath). Marked late atrophy of choroid and retina with extensive pigment proliferations, migrations, and fatty degenerations.

its soft compressible nature would have become apparent. Transillumination, however, would not "shine" through the thinned sclera because of its pigmented backing from the retina.

Another possibility to be thought of in the differential diagnosis of a small either pigmented or white mass at the limbus is a ciliary nerve loop. These are stationary and also lie below the conjunctiva and are fibrous, and fixed. A pigmented nevus would likely involve the conjunctiva. Again we have an example of the bizarre effects of trauma. The slogan—"never understimate the effects of trauma"—applies here.

The natural history of the eye may be briefly summarized:

Trauma, scleral rupture or weakening followed by development of a small staphyloma. Dislocated lens. Diffuse uveitis and extensive chorioretinitis causing scarring, atrophy, anterior synechia, and fatty cystic degeneration of the retina (fig. 4). Degenerated vitreous, cyclitic cataract. Secondary glaucoma of long standing with frequent phases of congestion; The glaucoma is related to bullous and band keratopathy. Cavernous atrophy of the optic nerve.

243 Charles Street (14).

Ophthalmic Miniature

In those days of forced education on the one hand, when unhappy children are compelled, both by parents and teachers, to pore over books, often of very small type, and other objects requiring accurate vision, for hours and hours together, with the head bent, the shoulders stooped, the abdomen compressed, and the legs often dangling in the air, in crowded, badly illuminated and ill-ventilated apartments;—when young ladies in the upper circles, and those girls in the middle ranks who are preparing to be governesses and teachers, are obliged to "practise" and read music for five and six hours a day;—when young gentlemen are induced, either by threats or emulation, to read for eight and ten hours a day, and in addition several hours of the night, under the glare of a strong gas light, in order to uphold the character of a school or master at the risk—often at the expense of sight and life—when on the other hand, unfortunate tradesmen are compelled by low wages, the high price of provisions, and scarcity of work to support their almost starving families by working in dark, damp cellars and garrets for fourteen or sixteen hours a day:—and when poor seamstresses and milliners are necessitated by the fashionable luxuries of the upper classes to work for no less than eighteen hours out of the twenty-four; and when we add to this the various factories and private trades which require the continuous application of the eye to minute objects, we wonder not that nearsightedness and impaired or altered vision should be now so common amongst us.

W. R. Wilde,
British Medical Journal, 1847.

NOTES, CASES, INSTRUMENTS

GLAUCOMA INDUCED BY AIR INJECTIONS INTO THE ANTERIOR CHAMBER

GEORGE J. WYMAN, M.D.
Peoria, Illinois

The purpose of this report is to present two cases in which glaucoma was produced by air injections into the anterior chamber. Both followed cataract extractions with total iridectomies. Some peculiarities of the glaucoma as well as its control by cyclodiathermy are also of interest.

Selinger[1] in his article advocating the use of air after cataract extraction concluded "by pressing back the iris-hyaloid diaphragm the air prevents blockage of the chamber angle and may prevent postoperative complications such as secondary glaucoma and iris prolapse."

Barkan[2] stated that he had observed a case of glaucoma following cataract extraction with a round pupil. Experimentally, Scheie[3] was unable to produce glaucoma by air injection in rabbits who had been subjected to total iridectomies.

CASE REPORTS

CASE 1

Mrs. C. M., a 48-year-old white woman, was first seen on April 4, 1950, with complaint of blurry vision of five years' duration. Examination revealed bilateral posterior polar cataracts with vision reduced to: R.E., counting fingers at three feet; L.E., 20/50. Tension recorded: R.E., 20 mm. Hg; L.E., 20 mm. Hg (Schiøtz).

On April 13, 1950, an intracapsular extraction was done on the right eye.

My usual technique is to instil two drops of one-percent atropine one hour before surgery. One drop of 10-percent neosynephrine is placed in the eye a few minutes before surgery. Section is made with a knife and enlarged with scissors. Three interrupted sutures are then placed and after a total iridectomy the lens is removed with combined traction and pressure with either a capsule forceps or the erisophake. Two or three additional sutures are then used to close the wound and a bubble of air is inserted into the chamber.

This extraction was entirely uneventful although she vomited postoperatively because of "gall-bladder trouble." The patient was extremely nervous. She was given her permanent glasses on May 25, 1950, at which time with a +13.0D. sph. vision was 20/20. The eye was soft and has remained so to this time.

On November 23, 1951, she returned stating that she desired to have the left eye operated. Vision at that time had fallen to 20/70. The aphakic eye read 20/20 with ease.

On November 29, 1951, the left eye was operated and an intracapsular lens extraction was done without incident, using the same technique. On the first postoperative day there was considerable vomiting but no complaint of pain. There was, however, no thought of anything unusual. On the first dressing it was observed that the pupil was very dilated.

The vomiting continued, however, and on the third postoperative day it was possible to examine the eye with some degree of thoroughness. The pupil was extremely dilated and only a rim of it could be seen. The air bubble could not be observed. A small iris incarceration was seen at the 10-o'clock position. DFP was instilled immediately as well as eserine ointment.

The vomiting ceased and the tension which was first checked with a tonometer on the seventh postoperative day was 35 mm. Hg. The patient was kept on DFP once daily and the area of iris incarceration was touched up with the cautery. However, the iris was only a tiny rim about the limbus and the anterior chamber was extremely shallow. The

hyaloid membrane was intact and not in contact with the cornea.

On December 24, 1951, with a cataract lens plus a pinhole the vision was 20/50. The tension was 30 mm. Hg. She was told to use the DFP once daily. On January 22, 1952, she was seen by Dr. C. L. Pannabecker in my absence and stated she had not used the DFP for five days and had pain since discontinuing it. She was placed back on DFP and the tension was then recorded as 50 mm. Hg on two occasions.

On February 9, 1952, I performed a cyclodialysis on the eye under general anesthesia. Within five days the tension was again 35 mm. Hg and, on February 15th, a cyclodiathermy was performed using 15 punctures five mm. back from the limbus about the whole circumference of the eye. The patient's eye then became very soft and on February 29, 1952, was 11.9 mm. Hg (Schiøtz). On April 26, 1952, it was 20 mm. Hg.

On August 19, 1952, with an aphakic lens the vision could be improved to 20/25−1. On September 22, 1952, she returned stating that the eye was again painful and the tension was recorded as 42 mm. Hg (Schiøtz). Vision still maintained at 20/25.

DFP, 1:100 adrenalin and four-percent pilocarpine were then tried but the tension fluctuated from 29 to 40 mm. Hg and, on November 24, 1952, a second cyclodiathermy was performed using eight punctures. The tension, however, again showed a tendency to rise and the patient was placed on four-percent pilocarpine, three times daily, with eserine ointment used at night. The tension has varied from (Schiøtz) 23 to 36 mm. Hg and on her last visit March 7, 1953, was 23 mm. Hg. The vision is still 20/25. There is slight cupping of the disc (fig. 1).

CASE 2.

Mrs. L. S., aged 64 years, was seen in June, 1950, and found to have hypermature cataracts in both eyes. On April 3, 1952, a

Fig. 1 (Wyman). Appearance of eyes in Case 1.

right intracapsular lens extraction was done. On the first dressing 24 hours after surgery, the pupil was seen to be very dilated. The air bubble was not visible in the anterior chamber. She did not complain of pain.

On the next day DFP was instilled in the eye at the dressing and daily thereafter but there was no observable decrease in the size of the pupil. Tension was taken on the sixth postoperative day and was (Schiøtz) 35 mm. Hg. She was then using DFP drops, twice daily.

On April 11th, the tension was 45 mm. Hg, and the next day, or on the eighth postoperative day, a cyclodiathermy was done in the lower half using eight punctures. Two days later the tension was still 28 mm. Hg. She was discharged from the hospital on April 15th with a tension of 28 mm. Hg in the aphakic eye.

The patient was followed in the office and on May 6, 1952, with a cataract lens the vision could be improved to 20/50−2. However, the tension was up to 37.5 mm. Hg despite DFP. On May 20th, it was 42 mm. Hg and further cyclodiathermy was advised.

In view of the poor result anticipated in the right eye, the patient was induced to have the left cataract removed by being told "lightning never strikes twice."

On May 26, 1952, under general anesthesia, the upper half of the globe in the right eye was treated with eight diathermy applications. The cataract in the left eye was then removed but no air was put into the anterior chamber at the close of surgery. Homatro-

Fig. 2 (Wyman). Appearance of eyes in Case 2.

pine was used instead of atropine preoperatively.

The postoperative course of the left eye was entirely normal. The tension in the right eye has been controlled; the highest tension recorded since cyclodiathermy being 30 mm. Hg on one occasion. On the last three examinations it has been 20 mm. Hg. She is using DFP every other day. The tension in the left eye has been consistently 14 to 16 mm. Hg. Glasses were prescribed on August 4, 1952, and with correction, vision is: R.E., 20/50+2; L.E., 20/30. See Figure 2.

Conclusion

1. Two cases of glaucoma developed following cataract extraction and the fellow eye when subjected to almost identical surgery did not develop it. The glaucoma, it was felt, was due to air blockage probably from the air bubble getting behind the iris. In neither case had vitreous been lost or prolapsed into the anterior chamber. The onset within 24 hours of surgery and the complete atrophy of the sphincter, as well as the failure to respond to the strongest miotics, appeared to be the characteristics of the glaucoma.

2. Cyclodiathermy was helpful in relieving the elevated tension; in one case it was used only eight days after cataract extraction.

3. Fairly good vision has been maintained in these eyes up to the present time.

4. Glaucoma can be induced by air injection after cataract extraction despite total iridectomies.

327 Jefferson Building (2).

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BENIGN CALCIFIED EPITHELIOMA OF EYELID*

Leo Zankan, M.D.
Reseda, California

Benign calcified epithelioma is a tumor of the skin which can appear anywhere on the body. There have been few reports in the literature of the tumor being found on the eyelid.

This unusual tumor of the skin was first reported by Malherbe and Chenantais[1] (1880). It was described as a circumscribed lesion of the skin, showing a marked tendency to necrosis and calcification. In Ch'in's[2] review of the literature (1933) he found 12 cases affecting the lids and brow out of 116 cases. Côté[3] (1936) reported 12 cases occurring in the skin, of which one case in his series involved the right upper eyelid.

The first report in ophthalmic literature of benign calcified epithelioma of the eyelid is that of Ashton[4] (1951), in which he presents three cases all occurring in females. It is interesting to note that in none of these cases involving the eyelid was the diagnosis even suggested clinically. In Case 1 of his series, the skin showed a spider nevus over the swelling. Ashton suggests that the reason for the paucity of the literature is that the cases

* From the Department of Ophthalmology of the College of Medical Evangelists Medical School.

have been misdiagnosed both clinically and histologically.

Duke-Elder[5] states that benign calcified epithelioma of the skin represents a neoplastic entity of low malignancy possibly derived from a sebaceous-gland anlage and exhibiting structural features intermediate in type between the ordinary epidermoid cyst and a basal-cell carminoma. Essentially it is a benign encapsulated lesion with few recurrences following excision.

Case report

A woman, aged 48 years, was first seen by me on December 31, 1951. Two months prior to this time she noticed a small mass on the right upper lid near the lid margin. She thought it was a stye. She was seen by her family physician who made an incision into the mass, and a few drops of blood appeared. The mass continued to enlarge. When first seen, it was about the size of a pea and felt firm and cystic.

Slitlamp examination revealed many corkscrew vessels over the growth. On January 18, 1952, the tumor was removed by a local excision and shelled out like a "pea from a pod." The clinical diagnosis was hemangioma of the lid. There has been no recurrence in 15 months (figs. 1 and 2).

Microscopic examination. This cyst contains blood mixed with epithelial debris. The cyst is lined by a thick and irregular layer of stratified squamous epithelium. This epithelium appears to have two components, one an inner component which is of well-differentiated epithelium.

Immediately outside of this, there is a layer of rapidly growing squamous epithelium which is poorly differentiated. This layer contains numerous mitotic figures and exhibits some evidence of peripheral invasion. This component has a low degree of malignant activity.

Although a connective tissue capsule surrounds much of the tumor, this capsule is imperfect and, at some places, the tumor comes to the margin of the specimen. Calcification at the periphery of the lesion is minimal. This lesion has similarities with the epithelioma of Malherbe (fig. 3).

Diagnosis. Benign calcified epithelioma of the eyelid.

Fig. 2 (Zankan). One year postoperative.

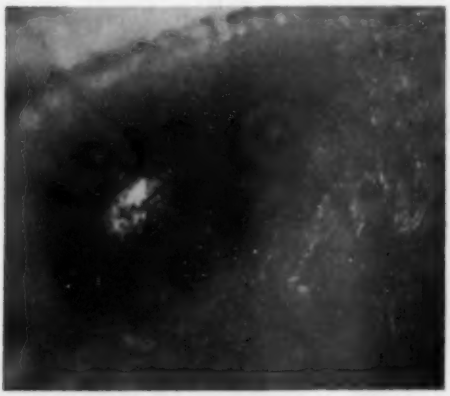

Fig. 1 (Zankan). Lesion of the right upper eyelid.

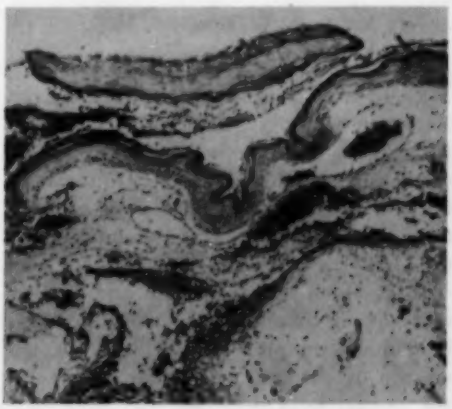

Fig. 3 (Zankan). Histologic picture. (Hematoxylin eosin.)

Discussion

The pathologic features of benign calcified epithelioma are fairly well established. The amount of calcium present in the tumors seems to vary a great deal. In the case herein presented, there was very little calcium, as in Cases 2 and 3 of Ashton.

The clinical diagnosis of this tumor offers a more difficult problem. A common feature of Ashton's first case, and this one, is increased vascularity in the skin over the tumor. This is probably due to the irritating nature of the lesion. This case and Ashton's three cases were all in women, which lends support to the impression of Malherbe, that the female sex is predisposed.

One should include the possibility of benign calcified epithelioma in diagnosing a lesion of the eyelid which appears firm, cystic, and more vascular than usual.

Summary

1. A case of benign calcified epithelioma of the eyelid is presented.

2. This tumor is probably a neoplasm of low malignancy which appears to be intermediate in type between an epidermoid cyst and a basal-cell carcinoma.

3. When a tumor of the lid is present, benign calcified epithelioma should be included in the differential diagnosis.

4. Though benign calcified epitheliomas of the skin are not common, those of the eyelid occur approximately one-tenth as frequently.

18308 Sherman Way.

Acknowledgements

I would like to thank Mr. Zolton Yuhasz of the Estelle Doheny Eye Foundation for the photographs.

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NEW INSTRUMENTS FOR CORNEAL REPAIR AND CORNEOSCLERAL SUTURING*

Michael Wainstock, M.D.
Detroit, Michigan

These two instruments were devised for corneoscleral suturing and are very suitable for grasping a split cornea section which under ordinary conditions is very difficult to do. For descriptive purposes, we can call them the single-toothed corneal forceps and the double-toothed corneal forceps.

It has been my experience and that of many of my colleagues that, when a corneal laceration occurs, it is often difficult to grasp one lip of the cornea which is usually in-

Fig. 1 (Wainstock). The single-toothed forceps.

* These instruments may be obtained from the Storz Instrument Company.

Fig. 2 (Wainstock). The double-toothed forceps.

verted toward the iris. The standard instruments are awkward and often slip off easily.

The single-toothed forceps, with its flat tip, is excellent for guiding in the edge of the wound where it can easily be grasped to insert the suture. The tooth is heavy enough for firm grasping of the cornea. This single-toothed forceps is very useful in suturing the corneoscleral sections in cataracts with a minimum of ocular disturbance.

The double-toothed flat forceps allows minimal corneal injury combined with maximum grasping ability. One variation of the instrument was lengthening the teeth 0.5 mm. which permitted the surgeon to grasp the cornea or sclera firmly with one hand and with the other guide the needle, held by the needle holder, directly between the lips of the forceps, with a minimal amount of ocular disturbance.

1508 David Broderick Tower (26).

A NEW TEST FOR ACCOMMODATION

JOHN A. EGAN, M.D.
Denver, Colorado

In working with the correcting cross cylinder, and more especially when determining the amount of presbyopic add, I discovered that it could also be used as a test for accommodation.

Present practical tests utilize a line of letters, a small letter, or lines for the patient to view. He is expected to tell the examiner when such objects first become blurred as they are slowly brought toward the eye. We all have had the experience of finding that the patient, though doing his best, was answering erroneously because of the fact that it is difficult to state positively when these objects *first* begin to blur.

In the test I am proposing, one eye being examined at a time, the full distance correction is worn. In front of this, a 0.25D. or 0.5D. correcting cross cylinder* is placed with its minus axis at 90 degrees. Next, a Jacques blur-point card, obtainable through your optician, is held before the eye. If the patient is not presbyopic, the horizontal and vertical lines of the black cross of the card will seem equally clear. The card is then brought slowly toward the eye until the horizontal lines appear blacker than the vertical. At this point a Prince rule is used to measure the accommodation as in other familiar tests.

If the patient is presbyopic, a +3.0D. sph. is added to the distance correction and the measurement taken as before, the 3.0D. being subtracted from the result.

What happens in the test is that the patient, who is not presbyopic in this instance, looking through the Jackson cross cylinder, accommodates, thus seeing the crossed lines on the Jacques' card equally blurred. There-

* A correcting cross cylinder is the same as a testing cross cylinder except that the latter has a long handle. The correcting cross cylinder has a short handle like any ordinary trial lens and fits in the trial case.

fore, one focal line lies in front of the retina and one behind the retina.

As the card is brought closer and closer to the eye, the patient finally is unable to accommodate further and both focal lines then are forced backward. The posterior one then lies behind the retina and, unless the card is brought too close to the eye, the anterior one lies on the retina making the horizontal lines clearer. (If the minus cylinder is placed at 180 degrees, the vertical lines would appear clearer.)

As mentioned before, I have found that it is difficult for patients to say exactly when a line or a letter first becomes blurred as it is brought nearer the eye. In the proposed test, the patient apparently can tell much more accurately when the horizontal cross lines, for instance, of the test card, become clearer than the vertical lines.

The chief reason for this lies in the fact that the patient has two items to compare, that is, the vertical and the horizontal lines; whereas, in the other common tests for accommodation, by the time the test object becomes a little blurred, the patient has forgotten what it looked like when it was farther from the eye and perfectly clear.

1765 Sherman Street (3).

Ophthalmic Miniature

You choose for the operation, a clear serene day; and fixing the Patient in a chair, opposite a well-lightened window, place yourself in another fronting him, which for this purpose, should be a little more elevated than his. Apply over the sound eye, some soft linen compresses, and then bind up the Eye, with a band or handkerchief, round the Head, which will prevent the other eye, from rouling, as also save the Patient from some anxiety, in knowing when, and how you go on. Having enjoined strict silence, to the spectators and assistants, give the Patient an oblique position: that is, if it be the Right Eye, you are to work on, let that side project a little more towards you, than the other, by which you make your incision freer. Nevertheless I would not recommend this position, to be used, indiscriminately; for a good deal depends on the form of the Eye, and the Operator must always prefer that posture, to his Patient, which gives himself the greatest ease and command. Let the lids be separated, by an assistant, and then the Surgeon holding the handle of the needle, between two fore-fingers and the thumb, with the black Line, of the handle, fronting him, pierces the Cornea transparens, just at the border of the Sclerotica, in the inferior middle part of the Eye, or at its lateral external angle, for the choice is no way material. The quantity of the instrument, that has entered the Cornea, will determine whether it is thoroughly pervaded, or no; it being in a Human Eye, but about ¼ Line: but a more exact Rule, is the spurting out of the aqueous humour, which sometimes flies in your face, at other times, dribbles down the cheek, according to the pressure on the Cornea, and breath of the incision. The convex part of the needle faces the Iris, and with its sides you gently dilate the Orifice, and then you remove your needle, and introduce the blade of your scissors, and dilate the Cornea, at its border, on both sides, till you have a fair view of the Pupilla which is done, by turning up the part of the Cornea, which has been dilated: you now introduce thro' the Pupilla, the Iris Needle, and dilate the Chrystalin Capsula, which being done, by a gentle pressure, on the inferior part of the Eye, you press out the Christalin: return the inverted part of the Cornea, and apply to the Eye, soft linen compresses, moistened in water, in which a little Saffron has been infused, and animated with a fourth part Brandy. Let the Patient be confined to a dark room, without much fire, and kept to a low diet, for three or four days—let him also, in this time avoid lying on either side, but rather, if possible, sleep in a perpendicular posture; at least, let his head be elevated, and cause him to lye on his back.

"A critical analysis of the new operation for a cataract,"
Mr. O'Halloran of Limerick, 1750.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

408th Meeting

November 19, 1952

DR. ANDREW L. MACMILLAN, JR., *presiding*

GONIOSCOPIC TECHNIQUE AND APPARATUS was discussed by DR. MILTON G. ROSS of Providence, Rhode Island, with illustrating slides.

GONIOSCOPIC FINDINGS IN GLAUCOMA were described by DR. W. MORTON GRANT of Boston.

WERNICKE'S DISEASE

DR. MAURICE VICTOR of Boston reported observations which he and DR. R. D. ADAMS made on 90 alcoholic patients exhibiting the symptoms of Wernicke's disease. All of these patients exhibited ocular signs, the commonest being nystagmus; less commonly, a paresis of a lateral rectus muscle; and, less frequent still, a paralysis of conjugate gaze or other oculomotor defects. None of these patients showed significant fundus changes.

Many of these patients showed mental disturbance, 73 percent of them severe enough to be classified as Korsakoff's psychosis. Ataxia was the third prominent sign, manifesting itself mainly as a disturbance of stance and gait. This symptom complex had a sudden onset but only seven of the patients died. (Wernicke considered a fatal outcome inevitable.)

Post-mortem examinations revealed varying degrees of necrosis of parenchymal structures and alterations in small blood vessels in the paraventricular regions of the thalamus and hypothalamus, through the mammillary bodies, the peri-aqueductal region of the midbrain, and floor of the fourth ventricle. No significant hemorrhagic lesions were found.

The symptoms respond promptly to thiamin, leading the authors to believe the disease is fundamentally a nutritional disturbance rather than a neurotoxic response to alcohol.

ANTIBIOTICS IN OPHTHALMOLOGY

DR. IRVING H. LEOPOLD of Philadelphia was the guest speaker. Early trends in anti-infection therapy were reviewed, tracing the development of antibiotics. More specific problems in antibiotic therapy were then discussed.

All antibiotic agents penetrate poorly through the intact cornea. Penetration is increased by using iontophoresis, subconjunctival injection, and adding detergents to the vehicle.

Penicillin, streptomycin, and aureomycin penetrate poorly into intraocular tissues and fluids when given in amounts commonly used for diseases elsewhere in the body. Better penetration occurs when massive doses are used and when ocular inflammation is present.

Chloramphenicol is the only antibiotic agent that penetrates intraocular tissues well when given orally. Terramycin will penetrate when given orally, but the dosage must be high.

All antibiotic agents produce iritis when injected directly into the anterior chamber, the severity depending on the concentration. Injection into the posterior part of the eye may cause disruption of the vitreous, chorioretinitis, and lens changes.

Antibiotics can cause various toxic reactions, such as hypersensitivity, renal disease, aural disease, gastro-intestinal disorders, and changes in the blood. Any of the antibiotics taken orally may produce moniliasis. Aplas-

tic anemia has occurred with the use of sulfonamides, and a few cases have been reported recently associated with the use of chloramphenicol. Aplastic anemia seems more apt to develop on readministration of the drug rather than on initial administration.

The actions of antibiotics when combined with one another may be synergistic, additive, antagonistic, or indifferent. Various combinations were discussed. Do not use them in combination unless it is definitely known that the combination is superior to one alone.

The prophylactic use of antibiotics before and after intraocular surgery was discussed and advocated. The antibiotic agent favored by the speaker was chloramphenicol because of its broad antibacterial spectrum and its ability to penetrate intraocular fluids and tissues. He suggested giving orally three gm. at least an hour or two prior to surgery and continuing the program for 36 hours after surgery. If chloramphenicol is contraindicated, use a combination of penicillin and streptomycin, giving them intravenously one hour before operation to be followed by intramuscular administration after operation. Terramycin and aureomycin can be used if necessary.

The use of cortisone in association with antibiotics was discussed. Experimental evidence was cited indicating that cortisone blocks the increase in permeability for penicillin in inflamed eyes. Cortisone and Compound F did not interfere with the increased penetration of streptomycin in inflamed eyes. Experiments were reported in which penicillin and cortisone were used separately and in combination in intraocular infections with Staphylococcus aureus, where the action of penicillin alone proved superior to that of the combination and superior to that of cortisone alone. Similar experiments with chloramphenicol and cortisone showed that the combination of chloramphenicol and cortisone was better than either agent alone.

Discussion. Dr. Milton Ross: In cases in which one wants to use cortisone to control ocular inflammation and, at the same time, wants to cover it with an antibiotic, assuming that one does not want to use chloramphenicol, is streptomycin-penicillin plus gantrisin a good over-all coverage combination?

Dr. Leopold: I see no objection to using penicillin and streptomycin along with cortisone. There is considerable evidence showing that cortisone does not interfere with the action of penicillin or with the action of streptomycin; and, therefore, that combination would be a good one. At the present time, I see no necessity of adding gantrisin unless you have a specific reason for using it in a particular case.

Dr. William Beetham: Would you say a word about the prophylactic use of these drugs? Would you recommend their use prior to cataract surgery or other intraocular surgery?

Dr. Leopold: I would certainly recommend their use, Dr. Beetham. The disadvantages, of course, are that if you are going to use these drugs on everybody, you are going to develop a colony of organisms which subsequently is going to be resistant to these drugs. The incidence of intraocular infection is extremely low, fortunately. If, however, such agents as neomycin, polymyxin, bacitracin could be used prophylactically it would be better than to use them systemically by which method they may produce renal damage or oral damage (neomycin does). If a sensitivity to one of these last-named compounds is developed, little is lost; whereas, if a sensitivity to penicillin and streptomycin is developed a great deal may be lost. For the same reason, it may be true that we can use chloramphenicol, because others are not going to use it very much for the fear of aplastic anemia. Maybe we ought to fear it, too.

Dr. Frederick Verhoeff: Can you inject enough antibiotics intravenously to injure the retina?

Dr. Leopold: I never have, Dr. Verhoeff. The most I have ever given intravenously is about the equivalent of a million units to a

70-kilo adult, and I have given 100,000 units per kilogram in rabbits without producing any retinal damage. The retina can be damaged by injecting more than 5,000 units of penicillin per one-tenth cc. directly into the vitreous. If you inject neomycin into the vitreous in excess of 250 mg., you produce neovascularization in the retina and closure of the vessels.

Dr. Frederick Verhoeff: I understand now that in all your private cataract operations you use prophylactic injections of antibiotics.

Dr. Leopold: Well, I have been using chloramphenicol up to the present moment—that is, orally.

Dr. Frederick Verhoeff: Don't you think you run just about as much chance of getting into trouble that way as you would by the slight danger of infection?

Dr. Leopold: Well, I don't think that there is any doubt that you run a risk with any of these antibiotics. A recent journal reported an anaphylactic death following one injection of penicillin. There is no doubt that it is a calculated risk.

Dr. Frederick Verhoeff: I think that somebody ought to express appreciation for this work you have done and how important it is to all of us. I think we all appreciate it very much.

Dr. Abraham Pollen: In this hospital, for many years, we took preoperative cultures and then we stopped it. What do you think of preoperative cultures so far as cataract surgery is concerned?

Dr. Leopold: I am afraid they do not help us very much. We do them routinely at Wills Hospital; and if there are many pathogenic organisms, operation is postponed until the infection is cleared. I don't think it is very significant, however. When we are unfortunate enough to get an infection and fortunate enough to get a culture, the organism is rarely one that we have ever found in the cul-de-sac. It usually comes from a contaminated bottle, we think, a solution, or some place in the ventilating system.

Dr. Bick: Do you use any topical prophylaxis of any kind?

Dr. Leopold: Yes, I have been using chloramphenicol drops, mostly because chloramphenicol has a wide spectrum; in the solution form it is stable, which most of these other antibiotics are not; and, therefore, we can keep it on the ward, use it regularly, and do not have to make it up fresh every day.

Dr. Harry Braconier: Do you have any observations on sulfonamides and cortisone?

Dr. Leopold: I am sorry, I do not.

Member: What strength of chloramphenicol do you use prophylactically?

Dr. Leopold: 2.5 mg. per cc.

Member: How frequently?

Dr. Leopold: We do it about every three hours in the 24-hour period prior to surgery.

Member: Any objection to the use of ointment?

Dr. Leopold: I see no objection. I rarely use ointments in infection, particularly corneal, because of the interference with epithelial regeneration due to the base more than the medicament itself; but I would see no objection to it. Of course, it will be flushed out before operation anyway.

Dr. Wollaston: Has anyone borne out Sprague's work on sodium propionate?

Dr. Leopold: Offhand, I don't know. I think there was a very favorable paper since. There have been some papers which have not been able to confirm those data, but I think last year I came across an article which did substantiate some of the work—in the foreign literature. I am afraid I don't know exactly where it was, though. It made reference to sodium propionate, five-percent solution, in the form of propion. Most people have not been able to show it to be a very effective antibacterial agent.

Dr. Brendon Leahy: How would you compare gantrisin given systemically with penicillin-streptomycin?

Dr. Leopold: I think penicillin is a bactericidal agent in the proper concentration. Sulfonamides are bacteriostatic. In experi-

mental infections done by von Sallmann and Grandé, I believe it was, in which they produced vitreous infections in rabbit eyes and treated them with penicillin and sulfonamides directly into the vitreous, they could not clear any of the eyes that were treated with the sulfonamides—even though they started therapy within four hours after the inoculation. Gantrisin was not available.

Gantrisin is a much more effective antibacterial agent than the sulfadiazine used, although the organisms were fairly susceptible to sulfadiazine. Gantrisin is not innocuous. There was a case—well, Dr. Gundersen's case had gantrisin—and the patient had a shock, which was probably allergic reaction; so that you may run into that difficulty. I don't have enough confidence in gantrisin or sulfamylon or any one of the sulfonamides alone to feel that they are adequate to treat an intraocular infection.

Dr. Sumner Liebman: There seems to be some feeling locally that the use of the antibiotic in the eye may produce a systemic allergy or sensitivity. Is there any evidence to that effect?

Dr. Leopold: Yes, I think that is true. I think it is possible for any one of these agents to produce a systemic allergic reaction. When the patient is given penicillin, for example, and gets a contact dermatitis from the penicillin, he may be given penicillin later with impunity without getting any trouble. At the same time, he may be given penicillin later, and it will cause a flare-up just with a local reaction; and there have been cases reported in which patients have acquired a generalized urticaria or angioneurotic edema following the systemic administration of penicillin. The same thing is true of sulfonamides.

Dr. Hugh Donahue: How about uveitis—nonspecific uveitis? Do you treat that in the same way, using drops?

Dr. Leopold: Well, I don't think I have ever seen a case of uveitis that I have been convinced has benefited from antibiotics. Perhaps tuberculosis might if it were the cause of the uveitis, but I haven't been convinced of that. There have been cases reported of choroiditis associated with gonococcal infection which have been said to clear; I haven't seen them. I have never been convinced that an antibiotic has cleared a case of uveitis, unless it is secondary to the corneal infection, or something like that.

Dr. David Cogan: If an organism becomes fast to an antibiotic, do you have any data on how long it remains fast?

Dr. Leopold: Well, staphylococci which have been studied can develop resistance in possibly two ways, as I see it. They can develop a penicillin-ase, which I believe remains in that particular organism regardless of the length of time. But, there is another type in which, by using penicillin in a certain dosage, you will kill off, let's say, most of the Staphylococcus aureus in the body; but there will be some of the Staphylococcus aurei which are more resistant to penicillin and will remain. They haven't developed a penicillin-ase and that strain will be more resistant, but it gradually will lose that ability to resist penicillin; whereas, those which develop penicillin-ase, I believe, maintain it for a long period of time.

As for streptomycin, I think the tubercle organism develops a resistance to streptomycin very readily, which that particular strain maintains for a long time; whereas, if you use it in combination with paraminosalicylic acid you can delay that development of resistance. Recently, there has been some work done in which streptomycin has been combined with terramycin in tuberculosis—terramycin being given every day and streptomycin being given every third day. The authors believe, although the evidence is not final, that they have also delayed the development of resistance of those organisms. I don't know whether that has answered your question or not.

Dr. Trygve Gundersen: Do you usually determine the susceptibility of the particular bacteria before deciding which antibiotic to use?

Dr. Leopold: Determining the susceptibility of bacteria in the laboratory and then

using that as a guide is, as a rule, as good a guide as we have, but it is not an infallible guide. Experimentally, you can produce a pneumonia in mice with a pneumococcus and not be able to control it with chloramphenicol. Take that same strain from patients with pneumonia, and chloramphenicol may clear up the pneumonia very rapidly.

Tularemia in mice failed to respond experimentally to chloramphenicol; and yet it is an ideal treatment for it in the human being. We did some work with terramycin and streptomycin and chloramphenicol, comparing them against a standard experimental keratitis, and found that some organisms which were rather resistant in the laboratory responded in the cornea—and just the reverse occurred; so it is not an infallible guide by any means. I would not delay my therapy at any time to await bacteriologic analysis. If, however, the patient is not getting better on the prescribed therapy, bacteriologic analysis is at least a reasonable guide.

Dr. William Beetham: Can you say how long you would continue to use streptomycin in a patient with tuberculous uveitis who develops perivascular hemorrhages?

Dr. Leopold: Dr. Woods recommends that it be kept up for at least 21 to 27 days to be beneficial.

Dr. William Beetham: You think two years would be much too long?

Dr. Leopold: If there was no tuberculosis of the chest, I certainly do.

Dr. William Beetham: In a patient's only eye with 20/70 vision, the disease process looked almost like Eales' disease. The process has been stopped, and the patient is afraid to stop the use of streptomycin.

Dr. Leopold: Well, you could have said you told the patient to stop, and he could have said he didn't hear you because he can't hear now.

Dr. Brendan Leahey: Last year down in Baltimore, speaking of streptomycin, I believe it was said that 41 days, advocated by the makers of streptomycin, was not long enough. It should be about 62 or 65 days to be an effective course of therapy.

Dr. Leopold: Well, as I say, I have never seen a case of uveitis which has responded to an antibiotic, including the theoretically acid-fast uveitis diagnosed by appearance and skin test. It may be the reason I have not seen a favorable case is that I have not treated them long enough. But, I am not sure enough of the diagnosis to want to risk the toxic effect of streptomycin.

Dr. Fred Dickerman: What is your choice of antibiotic for subconjunctival injection and how much is given and how frequently given?

Dr. Leopold: If it is an intraocular infection or corneal infection, I would say that a million units of penicillin and 50,000 µg. of streptomycin subconjunctivally would be my first choice and that should be given no more than twice a day at 12-hour intervals: first, in the upper cul-de-sac and then down in the lower bulbar conjunctiva or vice versa —in the meantime, continue local therapy by drops, say, every hour.

If the patient is not any better in 24 hours, I would switch to something else; and I would switch, depending on the organism—if you have obtained a culture—to terramycin or polymyxin if it seems to be susceptible to that. That would be my guide. I would use 250 mg. of polymyxin or terramycin in a few tenths of a cc.

Dr. Edwin Dunphy: Coming back to the prophylactic use of antibiotics before surgery, it has been the custom in this hospital to use chloramphenicol drops every two hours the day before the operation and sulfacetimide ointment at night; and we haven't felt it wise to use the antibiotics systemically for fear of developing a sensitivity.

Dr. Leopold: If the source of infection is from the cul-de-sac, then I woud think it is a reasonable compromise.

Dr. Edwin Dunphy: This is prophylaxis.

Dr. Leopold: Yes, but I don't know the site from which the infection arises. If it is arising from a drop, from an instrument, from the airway in the operating room, then I don't think that prophylaxis is worth anything. I think that is the problem.

Dr. Edwin Dunphy: Aren't patients going to be sensitized just as quickly with drops as they are systemically?

Dr. Leopold: Well, there isn't the danger by using drops of aplastic anemia, for example, from chloramphenicol; and if you are using sulfacetimide ointment, you haven't lost a great deal if you sensitize them to that. Of course, that is rarely used systemically. I think the problem is—I don't have it clear in my own mind, actually—that infection comes from some other source than the cul-de-sac. I think that you may cut down the percentage of infection to, let's say, less than one percent. You may cut down a tenth of that by cul-de-sac therapy, but I think the bulk of infection comes from some other source. Now, as for intraocular penetrating foreign bodies, you would think the subsequent infection would be due to the foreign body; but we are told that foreign bodies are usually sterile—they are flying at a high rate of speed and they are sterilized before they penetrate.

Dr. William Beetham: Have you at the Wills Hospital had intraocular infection since using prophylactic treatment?

Dr. Leopold: Not on the services that use the prophylactic regime.

Member: And how long has that been in effect?

Dr. Leopold: About a year and a half.

Member: Have there been any complications from the antibiotics?

Dr. Leopold: No.

Member: Is there an antibiotic which could be instilled at the time of operation with penetration into the eye?

Dr. Leopold: Yes. At Illinois Eye and Ear Infirmary, Dr. Hughes is using terramycin subconjunctivally at the close of the intraocular surgery.

Member: To penetrate into the vitreous and save using chloramphenicol until later?

Dr. Leopold: Well, as a therapy for intraocular infection. That is a good point. The only thing is—how many people like to inject subconjunctivally into an eye which has had an uneventful intracapsular cataract extraction?

Henry Adams Mosher,
Recorder.

MADRID OPHTHALMOLOGICAL SOCIETY

February 27, 1953

Dr. Marin Amat, *president*

Retinitis punctata albescens

Dr. Galindez-Iglesias read a paper on "A case of marked retinitis punctata albescens" with demonstration of the patient. He explained that the primary degenerations of the retina are associated with disorders of the pigment epithelium and for this reason Leber, in 1916, used the term "tapetoretinal degeneration." These cases embrace a series of processes which go from congenital night blindness, where there are no recognizable lesions in the fundus, to gyrate atrophy and choroideremia. Extreme degrees of chorioretinal degeneration have intermediate stages of, among others, retinitis pigmentosa and retinitis punctata albescens.

If we limit ourselves to the last-named condition we can say that the study of more than 50 cases by Dr. Carreras Matas, in 1946, and by me have shown that this process is intimately associated with retinitis pigmentosa, as it has been observed in several families in which some members have shown the first-named condition and other members have shown the second-named condition.

Rosanno has observed a patient who had retinitis pigmentosa in one eye and retinitis punctata albescens in the other: Giannini has confirmed, in a case of retinitis punctata albescens, the appearance of the Mizuo phenomenon in Oguchi's disease. All this verifies that these processes belong to the

group of tapetoretinal degenerations.

The term "retinitis punctata albescens" was proposed by Mooren in 1882 because of the ophthalmoscopic appearance. In 1910, Lauber, and later Franceschetti, showed that there were two clinical forms of the disease:

1. Fundus albi-punctatus with hemeralopia which is a simple, congenital form not associated with impaired vision.

2. Retinitis albi-punctata, which is progressive, associated with pigmentary and vascular lesions, and having a bad prognosis.

Most authors agree with this classification.

The clinical picture is characterized by the dissemination over the whole fundus of white spots, at times so small that they cannot be seen by indirect ophthalmoscopy. They are round and of uniform size, although sometimes there are larger ones due to a confluence of several small spots. They are free from pigment and take root beneath the retinal vessels. They are found all over the fundus except at the foveal zone. The vessels appear normal or slightly narrowed, the papilla appears normal or slightly pale, but not atrophic, and the fundus is depigmented.

Vision may be nearly normal, as in our case, with similarly normal color vision. The field of vision does not generally show any changes, although Duke-Elder says that 50 percent of the cases show a peripheral contraction. There is night blindness, ordinarily congenital, which, however, at times depends more on slow dark adaptation than on a change in the light threshold.

Gradle, Nettleship, Atkinson, and Henderson have published six cases in which the whitish spots disappeared. Vogt has seen a case of retinitis punctata albescens acquiring pigmentation, and in my case published in the *Bulletin* of the Medicopathological Institute there co-existed a fine stippled yellowish-white spot with pigment deposits. This would seem to indicate that retinitis albi-punctata has proceeded to the development of retinal pigmentary degeneration.

Although there is no doubt that the affection involves the outer layers of the retina, there are no detailed anatomic-pathologic studies.

What are these white spots made of? One must dismiss the idea of Wolflin that they consist of cholesterol crystals, also the idea that they are verrucosities of the lamina vitrea of the choroid (drusen). Leber thought that they are colloidal bodies, perhaps partly calcified, and Huber thought that they may be the products of an injury to the choriocapillaris. Bailliart affirmed that it was a cellular phenomenon, similar to that described by Redslob in retinitis pigmentosa.

Bietti has observed two cases of retinitis albi-punctata associated with polydactyly. As in my case cited before, it presents the Laurence-Moon-Biedl syndrome with the symptoms of obesity, hypogenitalism, mental retardation, polydactyly, and associated retinitis pigmentosa and retinitis punctata albescens.

It is, therefore, a case of Froelich's syndrome with congenital malformations in which possibly the retinitis albi-punctata was a later malformation. This syndrome is considered hypothalamic, resulting from a hypothalamic-hypophyseal block, which is so decisive in the production of congenital malformations. It is possible then that the benign and stationary form of retinitis punctata albescens can be considered a congenital malformation in my case. The father of the patient had multiple discolorations of the skin, a circumstance which Maranon attributes definitely to the hypothalamus.

The present patient, a 37-year-old woman, has a negative personal and family history, except for the multiple discolorations shown by her father. Externally the eye, including pupillary reflexes, motility, and visual fields, is normal. Vision is 2/3 after correction for a low compound myopic astigmatism. The fundus shows a very large number of the whitish spots which surround both maculas without, however, invading them. The papilla, the vessels, and the rest of the fundi

are normal. Examination of the light sense with the Feldman adaptometer shows marked hemeralopia. All this points to a case of retinitis punctata albescens of the "A" type as described by Lauber.

IDIOPATHIC DETACHMENT OF THE RETINA

DR. ARJONA said that clinical studies by many investigators (Arruga, Duke-Elder, and so forth) have shown that there is no single cause for this detachment. Although cystoid degeneration of the retina (Vogt) explains the separation in the large majority of cases, one cannot deny that, in some cases, there are other factors, such as traumatic traction on the vitreous and its detachment.

Likewise, the theory of involvement by exudates from vascular lesions in the choroid is applicable in certain cases.

It must be reiterated that the retina has a capacity for a functional recuperation when there is a reattachment, although in cases of extensive detachments the prognosis may be poor. This shows that the retina can maintain its vitality from the extensive subretinal fluid, though momentarily its functioning seems to have been lost.

Discussion. Dr. Marin-Amat said that he fully agreed with the speaker on three points:

1. The theory of vitreous traction on the retina causing detachment in the case cited. The detachment was above the point of traction which shows that it took place at the point of least resistance. He referred to his published works in which he showed that the tiny operculi in the retina are subject to traction by the vitreous.

2. It is also certain that the retina can be detached by something pushing it from behind, as is evidenced by detachments due to sarcoma of the choroid.

3. The detached retina retains for some time its capacity for functional rehabilitation when it is replaced and in contact with the pigment layer. The following case is proof of that:

A young woman suffered a myopic detachment of the retina for a year and a half, during which time there were several reattachments and detachments, until in December, 1952, she finally completely lost vision, and was told the condition was hopeless and inoperable. When I saw her I noted two enormous retinal pouches, one above and one below in the temporal half of the retina, which occupied almost the whole vitreous cavity. Vision was completely gone, without, however, any retinal tear being visible.

I kept her in bed with a binocular bandage for 48 hours, without any improvement. I, too, then considered the case inoperable. But at the insistent requests of the patient I consented to operate, without, however, giving her any favorable prognosis.

I did a plane and perforating diathermy-coagulation, first in the upper-outer quadrant and after in the lower-outer quadrant. An enormous quantity of subretinal fluid of a yellowish color escaped. On the fifth day the appearance of the eye was as if no operation had been performed. It showed that the choroidal mechanism for reabsorbing exudates was perfect. The retina was completely reattached and vision was normal.

In spite of this I was still pessimistic about the ultimate results and thus advised the patient. But after a month and a half of watching the patient I, too, am optimistic about the final outcome. It is clear that if there had been a tear in the foveal region, complete recovery of normal vision would have been impossible.

Joseph I. Pascal,
Translator.

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MEDICAL ETHICS AND PHILOSOPHY INVOLVED IN DISPENSING OF GLASSES BY OPHTHALMOLOGISTS

Following cessation of the rebate practice some years ago, and introduction of a trend for glasses to become expensive "costume jewelry," an increasing number of ophthalmologists contemplate dispensing the glasses they prescribe. This is true particularly in parts of the Midwest, South, and Far West. Among young ophthalmologists starting out in practice, the number who dispense glasses is increasing in those communities in which the practice is becoming more frequent. In the East, around university centers, in San Francisco, and in Pasadena, the practice is practically nonexistent.

The reasons given for dispensing glasses, by those who have changed to this system, are varied and include the following:

1. Since the end of the rebate era, the price of glasses has not declined but has risen, and since glasses are now "jewelry items" at $50.00 a frame and a different frame for every costume, the dispensing doctor asks: "Why give all this profit to a dispensing optician when it might be kept for oneself or part of it saved for the patient?"

2. The doctor has better control of the patient and can supply glasses and services more cheaply and is therefore better able to compete with group practice, insurance medicine, optometrists, and osteopaths.

3. Glasses are better fitted by an ophthalmologist as he is interested in the examination and in the end result, and he will not oversell the patient on merchandise.

4. Some doctors are unable to support themselves in ophthalmology without selling glasses.

5. Men in group practice have the advantage of an optical shop from which they derive profit, so the doctor practicing alone asks: "Why should the individual practitioner be deprived of profit because he cannot hide behind a group situation?"

6. Other medical groups are said to victimize the patient, for example, by fee-splitting, laboratory rebates, as when the laboratory is owned by the doctor, ghost surgery, sale of appliances, and dispensing of drugs. The dispensing doctor asks then: "Why should the ophthalmologist be an idealist and not a realist, since the tendency toward socialized medicine creeps irrevocably along, and his days of lucrative private practice are numbered?"

7. A new practice further penalizes the patient; namely, that owners of medical buildings collect percentage rent from opticians, a percentage which, no doubt, is reflected in the selling price, thereby maintaining the price of glasses at a high level.

8. The practitioner who is dispensing glasses because there is no dispensing optician in his community fears any action against dispensing lest his practice might suddenly be considered unethical if some optician should establish a dispensing shop in that community.

Now, some of these reasons given for dispensing glasses warrant our consideration in the light of the key ethical question as to what is best for the patient, the public, in the over-all picture and in the long run.

The argument that dispensing by the ophthalmologist will lower the price of glasses could be valid, but, human nature being what it is, this is unlikely when the very fact that a doctor wants to dispense glasses for a profit indicates so strongly that he will no more charitably cut the price in the interest of his patient than will the optometrist who sells 80 percent of the glasses in this country.

The argument that the profit is handed to the optician rather than to the patient may also be true. However, for the doctor to receive any profit will not help the patient. And is it not possible that it could put the doctor in an embarrassing position when advising the patient to buy glasses?

A more effective way to lower the price of glasses would be to insist that price lists be printed, segregating expensive from moderately priced merchandise, so that doctor and patient alike can readily compare prices in competing optical firms. Then, too, the optical firm supplying the dispensing doctor at wholesale prices should not be the same as the one serving the nondispensing ophthalmologists, for, otherwise, there can be no real competition to bring about lowering of the price of glasses.

The argument that an ophthalmologist cannot support himself without the added income from selling glasses may be valid in rare instances but, generally speaking, ophthalmology is one of the highest income specialties and the fitness of any individual to practice ophthalmology would be questioned if after eight to 10 years of preparation, he must sell glasses in order to survive in com-

petition with those groups which have very inferior training. Economically, such an individual would have been as well off with the much less expensive training afforded these groups. He might be helped by being encouraged to take graduate courses, to go into a small community where competition would be less stiff and where his professional training would be relatively more emphasized, but must we gauge professional goals and standards by the potentialities of such men?

The problem of buildings taking a percentage of the optician's profit as rent, and thereby contributing to the high cost of glasses, merits consideration by the entire medical profession. It can perhaps be stopped by a program of publicity brought to bear on those owners who are in this way indirectly collecting rent from the doctor and his patients.

The argument about victimizing the public would be unworthy of comment were it not for such unfavorable publicity as in *Collier's*, October 30, 1953, in the article "Why Some Doctors Should be in Jail." It is not for the best interest of the public that doctors be subjected to such criticism. To counteract this adverse publicity our goals and standards must be constantly brought to the attention of the public.

Obviously, one can rather easily rationalize the dispensing of glasses as being for the best interest of the patient; however, most dispensing is done for the profit involved. Only the very rare individual dispenses glasses solely for the convenience of patients and makes absolutely no profit from the sale of the glasses prescribed, not even money toward office expense over and above that associated with the actual dispensing of the glasses. Most dispensing ophthalmologists do make profit from dispensing but justify their actions, saying the glasses are costing their patients less.

Now is this rationalization in the best interest of the medical profession and of the patient? Superficially it may be, as the immediate patient in question appears to benefit, but where does the practice lead us? For those who follow, what legacy do we leave that may promote future benefits for patients? If we say, yes, it is ethical to make a profit on glasses we prescribe, one ophthalmologist will make 10 percent of his income in this way and another will make 90 percent. How are we going to set a limit as to what is right?

Certainly, if a substantial part of a man's income is derived from the sale of glasses he prescribes, the public might well believe that his medical and surgical interests are secondary and that his opinion as to the need of and the importance of glasses could be warped and prejudiced. Is he not fostering a tendency to charge for glasses rather than for professional services, since the unthinking public is more willing to buy tangible merchandise than to pay for services and advice, thereby depreciating the value of medical judgment? Is it fair to other doctors to belittle the value of medical judgment and service by reducing the fee for examination and refraction because compensation can be achieved from profit on the sale of merchandise related to that service? Is this in the best interest of medicine?

Why enshroud the ophthalmologist with classic professional stature and then allow him to profit from the sale of glasses, while not allowing the internist to sell drugs? To carry this attitude to its logical conclusion, why not allow all doctors to collect what profit they can, however they can, and throw aside all thought of professional ethics? Where is the line to be drawn?

Contrast this rationalization with our traditional ethical one forbidding any compromise on the part of the professional man concerning what is best for the patient. The value of expert professional opinion, implying impeccable authority and integrity, is destroyed and meaningless if any profit is derived by the professional man as an effect of his advice or opinion, other than that received "per se" for said opinion and advice.

This principle applies to all professional experts, whether lawyers, scientists, engineers, or doctors, and insures simply that:

"My expert advice is given unprejudiced by any consideration of profit. I do not alter my advice or opinion on the basis of any possible profit I might receive. I have no personal or financial interest in any business or activity that might be affected by this advice. I receive no money, immediately or remotely, from the sale of material of any kind, consummation of contracts, or change of organization, that might result from my advice or opinion. My advice and opinion are therefore expert and reliable. I take pride in them. They are valuable, and I am justified in charging a just fee for them."

Obviously, distinguishing oneself by belonging to a group that adheres to and publicizes such a code of ethics has inestimable value in strengthening public confidence, not to mention the over-all moral influence of such ideals and sense of honor. We saw an example of this sense of honor when Mr. Charles Wilson sold his General Motors stock. We see it each time a Supreme Court judge disqualifies himself from giving an opinion in a specific case because of some previous interest in one of the parties involved. In contrast, the failure of former Secretary of Labor, Durkin, to dissociate himself from the Plumbers' Union when he accepted his position in the government, was an unprofessional act, for he might well be assumed to have a prejudiced interest in any case involving his own union.

It is for professional men to lead in establishing a code of conduct, and not be led away from one. We should shape tendencies rather than be controlled by them. The argument given to belittle the value of having a definite code, namely, that a man is honest or dishonest, regardless of any stated code of ethics, fails to take into consideration the compelling power of group tradition and opinion in channeling an individual's actions in one direction or another. We can best distinguish ourselves from the various groups trained to fit and sell glasses who would compete with us by adhering to such a code. One might add, incidentally, that some of these groups are striving to attain a similar code of ethics in their endeavor to be regarded as professional men, and are manifesting more pride in striving to attain professional stature than are those of us who advocate relinquishing traditional professional standards.

Dispensing glasses in one's office is the only convenient way of getting glasses for a patient in some suburban areas, and dispensing glasses is not illegal or evil. As a matter of fact, if some doctors dispense glasses and others do not, the difference in methods of practice may have a tendency to lower the price of glasses particularly if competing optical houses supply the needs of these two groups. In the meantime, the doctors who do not dispense glasses, and are ethically uncompromising, elevate the professional reputation and prestige of medical men as a whole. It is up to the young ophthalmologist to make his choice as to which group he prefers to join.

In the future, it will be up to the medical schools to decide the advisability of training men in the prolonged traditional fashion only to have them derive over 50 percent of their income from a commercial practice. The schools properly ask:

"Would the time, money, and effort not be better spent giving optometrists an extra year of training in medical ophthalmology, giving them a degree, and letting them sell glasses with the public aware that they are commercially interested and are not truly professional men, and concentrate specialized training on the select few who will carry on according to accepted medical and surgical tradition?"

Such questions should be publicly discussed by the entire medical profession so that the public is made to realize that doctors are trying to set up standards for the best interest of the public.

In conclusion: There is nothing evil about being a merchant. The question is simply when does a trained professional man cease

to be a doctor and become a merchant? And then we ask: "Is being a merchant in the best over-all interest of the patient, now and in the future?"

Surely, men privileged to have such training as makes them eligible for examination by the American Board of Ophthalmology, and for membership in the important ophthalmological societies, will do what is best for the medical profession and for the public.

S. Rodman Irvine.

OBITUARY

DANIEL B. KIRBY
(1891-1953)

Ophthalmology lost one of its most able and respected practitioners with the passing of Daniel Bartholomew Kirby last December 27th. Dr. Kirby died of coronary thrombosis at his home in Pelham, New York.

His remarkable career, which included wide activity in professional organizations at home and abroad, as well as extensive teaching and writing, had brought him that most significant return, the devotion and faith of his immense practice. Independent of mind, Dr. Kirby had directed his intellectual gifts and his courage to a variety of surgical and pathologic problems in the ophthalmic field, ranging from the biology and chemistry of the lens to the surgical correction of coloboma. His contributions, particularly in the area of his greatest emphasis—cataract surgery—were great.

Born in Cleveland in 1891, Dr. Kirby attended John Carroll University where he received the B.A. and M.A. degrees. In 1916 he was awarded an M.D. degree by Western Reserve University. His next few years were spent as resident surgeon at Toronto General Hospital, as a lieutenant in the United States Navy during World War I, and as resident surgeon in ophthalmology at Bellevue Hospital, New York.

From 1923 to 1928, Dr. Kirby was associated with Dr. John M. Wheeler, who had a deep influence on the future career of the young surgeon. During the same period, he served as a research fellow in ophthalmology of the American Academy of Ophthalmology and Otolaryngology, receiving the Schneider prize for research in ophthalmology in 1928.

DANIEL B. KIRBY, M.D.

During the same year, he entered private practice.

Dr. Kirby was appointed associate clinical professor in ophthalmology, Columbia University College of Physicians and Surgeons, and surgeon in the Institute of Ophthalmology, Presbyterian Hospital. In 1940, he became director of Eye Service at Bellevue Hospital and professor of ophthalmology at New York University College of Medicine. After 1949, he was professor emeritus at New York University Post-Graduate Medical Center. Dr. Kirby served as consultant at various hospitals including Manhattan Eye, Ear, Nose, and Throat Hospital; New York Eye and Ear Infirmary; and St. Clare's Hospital.

The assignments, together with a large private practice, were paralleled by active participation in many professional associations, as well as by lecturing and writing. A

fellow of the New York Academy of Medicine and American College of Surgeons, Dr. Kirby was a member of the American Ophthalmological Society, New York Ophthalmological Society, and the American Academy of Ophthalmology and Otolaryngology. A member of the American Board of Ophthalmology for many years, he served as its chairman in 1945.

Deeply interested in ophthalmic programs in Latin America, he served as representative of the American Ophthalmological Society to the Pan-American Association of Ophthalmology and was a member of the Harvey Society of that organization. His contributions to ophthalmic practice throughout the world are reflected in his honorary membership in the ophthalmological societies of Brazil, Argentina, Chile, Peru, Cuba, Mexico, France, Turkey, and Greece.

His clarity of mind and lucidity of expression made Dr. Kirby much in demand as a teacher abroad as well as at home. He lectured extensively in various Latin-American countries as well as at Trinity College, Dublin, and, in 1950, at the International Congress of Ophthalmology in London. He was chairman of the symposium on cataract surgery at the 1953 meeting of the American Academy of Ophthalmology and Otolaryngology. Just before his death, Dr. Kirby was elected professor honoris causa of the Paulista School of Medicine in São Paulo, Brazil. At the time of his death, he had been scheduled to give the Bedell Lecture at the Wills Eye Hospital in Philadelphia and to address the Interim Congress of the Pan-American Association of Ophthalmology in July.

A prolific writer, Dr. Kirby contributed a great number of articles, monographs, and textbooks. All his spare time, as well as vacations, was devoted to these publications. Their range is a measure of his achievement. Fields of his particular interest include the etiology of cataract, plastic surgery of the eye, the training of the ophthalmic surgeon, and studies on cell culture of the lens epithelium, a problem of particular interest to him. The bulk of his writing, however, dealt with his specialty, cataract surgery, including his original operative techniques, instruments, postoperative complications, and recommended procedures in difficult cases. He introduced the use of curare in selected surgical cases. His *Surgery of Cataract* appeared in 1950, and a companion textbook, *Advanced Surgery of Cataract*, was in press at the time of his death.

In 1923, Dr. Kirby married Cecilia Katherine Hahn. There are four children: Mrs. J. Dukes Wooter, Jr., (Mary Elizabeth) of Boston; Mother Joan Kirby, Overbrook Convent of the Sacred Heart, Philadelphia; and the Misses Cecilia Robinson Kirby and Janet Whitaker Kirby. Devoted to his family, Dr. Kirby was a devout Roman Catholic, a Knight of Malta, and a Knight of the Holy Sepulchre.

A member of the Union Club, New York, and the Westchester Country Club, Dr. Kirby in fact spent very little time on hobbies or amusements, dedicating his entire life to his profession. He brought to his work a combination of high intelligence and practical clinical judgment, together with keen insight into the problems of his patients. He had their absolute confidence.

His achievements in surgery reflected his ability, his meticulous conscientiousness, and courage to experiment. His was the bold, honest scientific spirit which, relying upon itself, extends the frontiers of human knowledge and skill.

J. Gordon Cole.

XVII INTERNATIONAL CONGRESS OF OPHTHALMOLOGY

Montreal, Canada—September 10 and 11, 1954

New York City—September 13 through 17, 1954

Subjects for discussion: *Glaucoma* and *Uveitis*

The International Council of Ophthalmology

The first International Congress of Ophthalmology, which was one of the first international congresses held, took place in Brussels in the year 1857. From that time ophthalmological congresses assembled during half a century fairly regularly every fifth year until a break in the sequence was caused by the First World War. Thus the XII Congress which was to have begun on the first of August, 1914, the same day that war broke out, never took place and the congresses came to a standstill.

In 1920, ophthalmologists of the United States transmitted through the Department of State an invitation to the foreign societies to send representatives to an International Ophthalmological Congress in Washington in 1922. The invitation could, however, be forwarded only to states with which the United States government was at that time in diplomatic relation and thus, among others, German and Austrian colleagues were not invited. For this reason that congress could not take the due number in the series of International Congresses and carries the name of an *International Ophthalmological Congress in Washington, 1922.*

A convention of English-speaking ophthalmologists took place in London, July 14 to 17, 1925. In the hope of bringing together an International Congress, this convention appointed a commission to work for that end. It was composed of Treacher Collins, Leslie Paton, Sir John Parsons, George E. deSchweinitz, and Walter Parker. This Anglo-Saxon committee took up the matter with the Dutch colleagues and their deliberations led to an invitation to all ophthalmological societies to send two representatives to a convention in Haag-Scheveningen in July, 1927, for the discussion of the re-establishment of the old international relations. On July 12, 1927, 43 delegates of 24 different nations met in Scheveningen. A committee report proposed an international council to direct the congresses. That proposition was accepted on July 14, 1927, from which day the International Council of Ophthalmology dates its existence. The council was to be elected at a general assembly of the congress and was to be composed of a president, vice-president, secretary, treasurer, and eight members. The following were elected: President, J. van der Hoeve; vice-president, Lundsgaard; secretary, E. Marx; treasurer, Leslie Paton; members: T. Axenfeld, W. G. M. Beyers, Coppez, M. Marquez, J. Meller, P. Morax, G. Ovio, and G. deSchweinitz. Finally the convention decided to accept an invitation from the Dutch ophthalmologists and the Dutch professors of ophthalmology to hold the next International Congress in Amsterdam in September, 1929.

William L. Benedict.

CORRESPONDENCE

Chloresium and lysozyme in healing torpid corneal ulcers

Editor,
American Journal of Ophthalmology:

I should like to supplement the experimental data of Cole and Hughes in the November, 1953, issue of The Journal (page 1508) in which chloresium ointment was shown to have a favorable effect in healing abraded corneas in rabbits. Since 1946, I have used chloresium solution in various types of sluggish corneal ulcers with gratifying results. The chloresium solution induced epithelization after failure of other remedies, in corneal ulcers incident to the keratopathy of absolute glaucoma, in pannus ulcers of trachoma, in metaherpetic ulcers, in epidemic keratoconjunctivitis, and in ulcus serpens after control of the infective process. Chloresium® solution (plain) N.N.R. contains the purified water-soluble derivatives of chlorophyll "a" in a suitably buffered isotonic saline solution. It is stable, nonstaining, and produces no irritation or other side effects. The patient instills a drop in the affected eye every two to three hours, followed by hot applications.

The healing effect of precipitated red blood cells on chronic ulcers was noted in the last war. The chelate structure of chlorophyll is similar to that of the pigment in hemoglobin except that the central ion is magnesium instead of iron. In commercial chlorophyll, copper is substituted for magnesium to insure stability—a change that tends to make chlorophyll even more analagous to blood. The invertebrate king crab has real blue blood since copper, not iron, is the central ion of his respiratory pigment.

After reading, in 1930, a report that the sulfhydryl radical promoted mitosis, I tested the chemical used, thiocresol, in the recommended concentration, 1:10,000 in isotonic saline, on corneal ulcers of various types produced experimentally in rabbits. In all cases the control traumatic ulcer healed as fast as that treated with the thiocresol solution or ointment. The negative results were not reported as it seemed probable that these induced ulcers were not comparable to the torpid corneal ulcer encountered clinically. In patients the results were very often excellent but whether the cures were due to the sulfhydryl radical or to the mildness of the remedy was open to question as favorable responses had been reported in such cases with Locke's solution only. I was hence happy to learn that in regard to chloresium the experimental evaluation lends confirmatory support to the validity of the clinical observations.

Smelser and Ozanics in the same issue (THE JOURNAL, November, 1953, page 1545) find that mitosis is promoted in the rat's cornea by removal of the Harderian and lacrimal glands. The newborn child has no tears and this deficiency has been considered partly responsible for the special susceptibility to ophthalmia neonatorum. About two decades ago, I essayed the treatment of such cases with artificial tears prepared by diluting eggwhite with an equal amount of isotonic saline. The preparation contained lysozyme in the same titer as human tears and six-percent protein, almost the same concentration as plasma. The project was abandoned because a deleterious action was soon apparent, possibly due to the mucolytic action of lysozyme on the corneal polysaccharides. I have, however, used the preparation with success in some cases of keratoconjunctivitis sicca not adequately benefited by methylcellulose drops.

(Signed) James E. Lebensohn,
Chicago, Illinois.

BOOK REVIEWS

OPHTHALMOLOGIC DIAGNOSIS. By F. Herbert Haessler, M.D. Baltimore, The Williams & Wilkins Company, 1953. Clothbound, 387 pages, 151 illustrations. Price: $8.00.

This book represents one of the few excursions in the American literature into the field of ophthalmologic diagnosis. The stated purpose of the book is to select from the literature those ophthalmologic data that are necessary for diagnosis and to present them in an arrangement that makes them useful for the recognition of the nature of ophthalmic disease.

The first chapter concerns history-taking and principles of physical examination, while the next four chapters cover the various diagnostic procedures useful in evaluating the manifestations of disease of the various anatomic regions of the eye. The following four chapters the author presents as "a series of essays in which further comment is elaborated to elucidate the situations in which it seemed to me that help would be welcome." These chapters consist essentially of a more detailed discussion of specific diseases of the various regions, particularly in relation to differential diagnosis.

The 151 illustrations are all line drawings, the majority of them diagrammatic. This is apparently an attempt to emphasize mechanism of disease manifestation rather than its actual appearance.

It is believed that the chief use of this book will be for the orientation of beginners

in the field of ophthalmology in relation to the multitudinous manifestations of ophthalmic disease, not only by their appearance but also by their fundamental mechanisms and etiologic backgrounds.

T. E. Sanders.

PUBLICATIONS, AMERICAN FOUNDATION FOR THE BLIND, New York, New York. *Estimated Prevalence of Blindness in the United States.* By Ralph G. Hurlin. 15 pages. Price: 25 cents.

Accurate statistics on blindness, periodically compiled, indicate the value of measures taken to prevent blindness and to help in the programs of service for the afflicted. The Section on Ophthalmology, A.M.A., in 1934 defined total blindness as lack of light perception; economic blindness as acuity of less than 0.1 Snellen, or an equal disability in the visual field. The older age group now accounts for at least two thirds of existing blindness. Blindness is also consistently more prevalent in the nonwhite population. Utah has the lowest rate, 1.4 per 1,000; New Mexico, the highest, with a rate of 3.4 per 1,000.

Normal Growth and Development of Children with Visual Handicaps. By Robert F. Mikell, M.D. 14 pages. Price: 25 cents.

The developing and learning processes in blind and seeing children are not comparable. The problems encountered are more difficult for the blind and their solution requires much more time.

Current Research in Work for the Blind. By Nathaniel J. Raskin and Marian F. Weller. 34 pages. Price: 50 cents.

The increase in the number of preschool blind children due to the incidence of retrolental fibroplasia has been a spur to research and may throw light on the importance of parental attitudes in the psychologic development of the blind. Research on the education of the blind, however, appears to be now at a low level.

Hobbies of Blind Adults. By Charles G. Ritter. 52 pages. Price: 45 cents.

Any activity which is pursued for fun rather than for income may be regarded as a hobby. Blindness should cause few changes except in the techniques of doing things. Many blind make no use of braille but employ tape recorders or dictation machines. Those who learn touch typing have no trouble in accustoming themselves to typing without looking. For embroidery, weaving may make a good substitute; ceramics for china painting; the phonograph for the camera. Some blind people enjoy going to art galleries with friends who describe pictures. Indeed, there have been art collectors who continued to buy pictures after becoming blind.

James E. Lebensohn.

TOXOPLASMOSE OCULAR. By Sylvio Abreu Fialho, M.D. Rio de Janeiro, Brazil, Empresa Gráfica Ouvidor S.A., 1953. Paper covered, 402 pages. Prepared as thesis for the Chair of Clinical Ophthalmology of the Medical Faculty of the University of Brazil.

This exhaustive monograph reviews the world literature on ocular toxoplasmosis and presents a valuable chapter on the author's personal observations and investigations. Among the outstanding of the 10 well-written chapters are those dealing with the clinical picture of the disease, its ocular manifestations, and its histopathology. In agreement with most writers, the author divides toxoplasmosis into three main forms: the congenital, the latent (found in adults as the transmittors of the parasite), and the postnatal (seen in both children and adults). The 63 illustrations include black and white retinographic studies, roentgenograms, and photomicrographs. The volume closes with the author's conclusions and a complete bibliography of 217 references.

This valuable book brings the reader up-to-date in a field of ophthalmology in which

workers in all of the Americas have made notable contributions.

Charles A. Perera.

BULLETIN OF THE BELGIAN OPHTHALMOLOGICAL SOCIETY. Bruxelles, Imprimerie Medicale et Scientifique, Rue del'Orient 67. February, 1952, June, 1952, and November, 1952.

The February, 1952, *Transactions* contains a comprehensive report by Jean Michiels on the chemical, biologic, and pharmacologic properties of streptomycin, aureomycin, terramycin, chloramphenicol, and other more or less effective antibiotics and of their clinical effect on ocular and extraocular lesions. Also in this report are descriptions of methods of applying antibiotics, hazards in their use, and possible toxic and allergic reactions. Special emphasis was put on the successful treatment of retrobulbar neuritis with aureomycin.

In the last paper of this session, Thomas, Cordier, and Algan considered a specific type of spontaneous luxation of the lens as part of a new syndrome (Ehlers-Danlos). This is a general disorder of the mesoderm and consists in hyperelasticity and fragility of the skin and hyperelasticity of the joints. A weakness of the zonula could well be a part of a systemic disease of this kind. The authors observed a 48-year-old man who showed all these signs and symptoms and also had a subluxated cloudy lens. In spite of an uneventful cataract extraction, the wound did not heal and had to be repaired twice.

In the June, 1952, *Transactions*, J. François and M. Rabaey report their studies with the phase-contrast microscope and recommend its use for examination of the lens, corneal endothelium, and pigment epithelium. They also made suggestions for the examination of the corneal stroma by increasing the contrast in such a way as to make the collagen and mucoid part of the stroma selectively visible.

J. François, R. Moens, and R. Moens (Gand) discuss the basic principles and advantages of the electrotonometer. J. Zanen presents a new and practical method for the study of the central color fields.

M. Appelmans and P. Lebas review the history and give the modern concepts of systemic elastosis and complicating chorioretinal lesions. They stress the importance of a survey not only of the skin but also of the cardiovascular system and the intestinal tract if disturbances of this kind are suspected. Since this is a generalized disease of the elastic tissue, a full examination of Bowman's membrane, Descemet's membrane, sclera, conjunctiva, synovial membranes, and the basal membrane of the inner ear are recommended. Senile and other types of macular degenerations occasionally are monosymptomatic cases of pseudoxanthoma elasticum. Generalized elastosis often is accompanied by a hypercholesteremia.

A. Meunier has an interesting paper on concomitant squint with diplopia. Sevrin and Callier draw attention to the disturbances of convergence in exophoria and discuss the most simple and most practical methods for the treatment of these disturbances. F. Roussel discusses the differential diagnosis of vertical diplopia. He describes the coordimeter of Hess and its use, as well as Franceschetti's procedures.

L. Alearts surveys the causes of blindness in Brussels for the last 14 years. It is interesting that 21.06 percent of the blindness resulted from inflammatory diseases in spite of the use of antibiotics. G. Sevrin and J. Lambrechts recommend five-percent pyribenzamine for the treatment of allergic conjunctivitis.

J. François and J. P. Deweer review the etiology of tuberous sclerosis and give a detailed report on a case of their own. Special attention is paid to neurologic disturbances and electro-encephalography. Deviations and asymmetry in the occipital leads and paroxysms in the occipital leads, more pronounced in hyperventilation than in stroboscopy, were thought characteristic for this disease.

M. Appelmans and L. Heffinck recommend systemic cortisone treatment in retrobulbar neuritis but etiologic treatment should not be neglected. J. François, G. Verriet, and G. Mortier suggest fever therapy in retinopathy of malignant hypertension. P. Huwart demonstrates and discusses a new instrument for enucleation.

At the third annual meeting of the Belgian Ophthalmological Society, held in Brussels, November 30, 1952, E. Redslob and A. Lobstein reviewed Schreck's explanation of the origin of sympathetic ophthalmia together with their own theories.

J. Nordmann and Paul Mandel ascribed experimental naphthalene cataract to a disturbance of the carbohydrate metabolism, which precedes the formation of lens opacities and which differs from the disturbances observed in alloxan diabetes and galactosuria.

A. Lobstein discussed retinal hypotension in general hypertension. A. Fritz and F. Bingen analyzed the anatomic dissimilarities and the functional similarities in retinal and chorioidal circulation. R. Weekers and J. Delmarcelle described a new fluorometer for the clinical evaluation of the formation of aqueous. They used it in 20 normal subjects and in five patients with ocular hypotension.

M. M. Hoorens and Piette reported their observation on a new miotic, Mintacol (DNP) with which they experimented in rabbit and dog eyes, using a solution of 1/6,000. Adrenaline and noradrenaline apparently act as direct antagonists.

M. Fritz studied the neurovascular components in the etiology of glaucoma and emphasized the importance of the sympathicocapillary mechanism. J. François and M. Rabaey gave a very interesting paper on the histochemistry of the corneal mucoids. They believe that the ingrowth of vessels into the cornea does not require destruction of the mucoids, that the high concentration of mucoids prevents the ingrowth of vessels, and that a diminution of that concentration as, for instance, a swelling of the tissue, favors progressive vascularization.

A. Fritz and J. S. Gillis contributed a paper on Marfan's syndrome. J. François and A. deRouck read a case history on congenital hereditary aplasia of the iris which they consider to be an incomplete form of aniridia.

J. François gave a very complete re-evaluation of Fuchs' heterochromia and places this type of heterochromia among the ocular degenerations. He points to the formation of vascular sclerosed loops in the chamber angle as the cause of the characteristic anterior-chamber hemorrhage and to the paralysis of the sympathetic. All these factors should be considered whenever complicating cataract or glaucoma necessitates surgery.

P. Danis and M. Brihae-vanGeertruyden described a case of congenital oculofacial paralysis. M. Appelmans, J. Michiels, and E. Carlier emphasized the diversity of ocular and extraocular manifestations in hemiatrophy and named the symptom complex of body asymmetry anisosomia.

A. Potvin, A. Bossu, and L. Schwarz reviewed the ocular complications of poliomyelitis. Hyperemia of the disc and papilledema are frequent in serious forms of this disease; they appear early, are bilateral, and recede slowly. They are accompanied by inflammatory changes of the intracranial parts of the optic nerve as proven by anatomic specimens in early lethal cases.

J. Zanen and F. Missaen discussed the merits of a checker-board type visual-acuity chart. R. Weekers and J. Delmarcelle contributed a very valuable lecture on aphakic glaucoma in connection with a late formation of the anterior chamber and interpreted its pathogenesis and treatment.

F. Bingen described traumatic vitreous prolapse into the anterior chamber. G. Pirot called attention to the value of gonioscopy in foreign bodies of the chamber-angle. G. R. Hoffmann and J. Kluyskens reported on the merits of angiography in connection with four cases of intracranial tumors.

A. deJaeger and Bernolet read a paper on fusion in strabismus; Henri A. deLaet dis-

cussed orthoptics. J. François and J. P Deweer gave the characteristic facts of sex-linked albinism and described the fundus picture in the female carrier.

J. François, J. Behaert and R. Stefens studied the pathogenesis of the Bardet-Biedl syndrome. Extensive clinical, endocrinologic, and electro-encephalographic experiments proved that, at least in their cases, the lesions were not localized in the region of the diencephalon and hypophysis but were a diffuse congenital dysgenesis of the entire brain.

Alice R. Deutsch.

THE BOOK OF HEALTH. R. Lee Clark, Jr., M.D., and Russell W. Cumley, Ph.D., Editors-in-Chief. New York 28 (155 East 82nd Street), Elsevier Press, Inc., 1953. 770 pages, 1400 illustrations, statistical appendix, 64-page illustrated glossary and index. Price: $10.00.

This handsome book represents the combined efforts of over 300 physicians, dentists, nurses, pharmacologists, university professors, writers, research scientists, librarians, artists, and photographers. Although designed to give the layman "the clearest and most complete medical information available," it will be welcomed by many auxiliary workers in the fields of medicine and health.

Of the 28 chapters in the book, one, Chapter 17, is devoted to the eye. It was edited by Dr. Brittain F. Payne, Dr. R. M. Watrous, Col. Victor A. Byrnes, and Dr. Richard G. Scobee.

Not less interesting than the subject divisions of the chapter is the emphasis, both pictorial and verbal, apportioned the various categories. For example, almost three pages are devoted to corneal transplantation; 18 lines to glaucoma.

The subjects discussed in Chapter 17 are: The Eye: what it is and does, the retina. Disorders of the eye: conjunctivitis, pink eye, stye; the cornea, corneal transplantation, eye-banks, eyes should not be willed; cataract and glaucoma; tumors; eyestrain, effect of lighting on eyestrain, optical defects, near- and farsightedness, other visual defects; glasses, glass eyes; retinal displacement; degeneration of the eyes. The blind: their care and opportunities, care for the newly blinded, education, schools, legal benefits.

The illustrations for this chapter on the eye are excellent. There is a full-page plate showing anatomic details of the eye, eight beautiful color illustrations of the technique of corneal transplantation, and a full-page black and white illustration of the receipt of a donor eye at an eye-bank. A two-page spread shows how contact glasses are made and how zylonite frames are made. There are numerous small pictures of Henry Smith, von Graefe, Braille, Hauy, von Hippel, Thomas Young, William Cheselden, Helen Keller, Benjamin Franklin (bifocals), and others, and a full-page, in color, of the Dvorine Color Blind Test.

Reference to the eye is not, however, limited to Chapter 17. On page 35, eyes of the newborn are discussed; on page 90 is a description of how the eye functions. And here and there throughout the book are references to eye symptoms in various diseases or to the effect of various diseases on the eye.

The final chapter in the book, entitled "The Medical Profession," is a distinct contribution to better public relations. From it the reader learns how a doctor, nurse, dentist, or pharmacist is trained. He is told how a hospital is organized and operated. He is acquainted with the work of technologists and therapists; with the drug industry and health organizations.

Ophthalmologists need not hesitate to recommend this book. It should be on reference —and if possible, on loan—in every public library, for it provides complete and reliable medical information for laymen.

Katherine Chalkley.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Bignell, John L. **Investigations into the blood supply of the optic nerve with special reference to the lamina cribrosa region.** Tr. Ophth. Soc. Australia **12**:105-108, 1953.

Variations in the vascular supply to the anterior portions of the optic nerve are very great. The central retinal artery gives branches to the optic nerve in the region posterior to the lamina cribrosa as well as its other fields of distribution.

Ronald Lowe.

Engelbrecht, Wolfgang. **The epithelial and subepithelial nerve endings in the human cornea.** Arch. f. Ophth. **154**:65-79, 1953.

Serial sections of seven human corneas were studied. The author used Ziesmer's modification of Bodian's silver stain. In the marginal zone of the cornea curled-up nerve fibers produce loop-shaped nerve endings. In the central area of the cornea the nerve endings are situated in the basal epithelial cells. Small fibers form knob-like endings within the cytoplasm, from which still smaller fibers travel to the cell nucleus and apparently touch the nuclear membrane. (10 figures, 21 references)

Ernst Schmerl.

Naylor, E. J. **Polarized light studies of corneal structure.** Brit. J. Ophth. **37**:77-84, Feb., 1953.

The corneal discs exhibited both form and intrinsic birefringence of positive sign. The refractive index of the micelles was found to be between 1.50 and 1.52, which is low compared to that of most other physiological proteins. The presence of intrinsic birefringence denotes molecular asymmetry, and its positive sign indicates that the molecules have their long axes in the fiber direction. Swelling and fixation bring about no gross disorientation of the molecules.

The corneal stroma of the cat was investigated by polarized light techniques adapted to the purpose. The observations suggest that a small proportion (roughly 5 percent) of the long-chain molecules form extremely small micelles, the nature and distribution of which are discussed; these have the (comparatively) low refractive index of 1.50-1.52. These aggregated and unaggregated molecules

make up the corneal fibrils, around which lie hydration layers of varying density; bundles of these fibrils constitute the corneal fibers which form about one hundred layers (lamellae) each about 5 μ thick. No evidence has been found of any preferential orientation of fiber directions in different lamellae. The origins of the interfibrillar and interlamellar spaces are considered and the effects of swelling and the relationship of the structure to transparency in the fresh and fixed cornea are discussed. (5 figures, 19 references)

Orwyn H. Ellis.

O'Day, Kevin. **Observations on the eye of the Monotreme.** Tr. Ophth. Soc. Australia **12**:95-103, 1952.

Histologic sections of eyes of the echidna and platypus are described in detail. The echidna has an avascular retina with only rod cells. The platypus has three types of visual cells, a single cone, a double cone and a rod. The retinas are more akin to those of the birds, reptiles and vertebrates than to the other mammals. Each animal has a lens pad at the equator, a constant finding in birds and reptiles with the exception of snakes. Cartilage is present in the sclera. Ronald Lowe.

Redslob, E. **The dilatator of the pupil.** Ann. d'ocul. **186**:289-311, April, 1953.

There are two opinions concerning the nature of the dilatator pupillae. The one most generally accepted is that it is elaborated from iris epithelium. The second, less accepted, considers it as made from smooth muscle fibers. The authors support the latter theory, on the basis of histologic findings. (44 references, 6 figures)

John C. Locke.

Rossi, Antonio A. **Structure of the vitreous body. Observations by means of the phase-contrast microscope.** Brit. J. Ophth. **37**:343-348, June, 1953.

The author studied both fresh, old, and fixed vitreous with the phase-contrast microscope. It was never possible to detect a true microscopic fibrous structure in the very fresh untreated samples obtained from any part of the vitreous body of animals. The only formations observed were indistinct structures which with very high magnification resembled crystals. After the eyes had been open for a while fibrillar structures appeared if the vitreous was exposed and its fluid allowed to drip away. In these vitreous bodies an irregular fibrillar network was seen in specimens collected both from in front and from behind the equator. A microscopic fibrous structure, similar to but not identical with the picture was clearly observed in the vitreous of the animals when the preparations were treated with fixatives. This was ascribed to the precipitation of the protein constituent by the fixatives. A fibrous structure was detected either in front of or behind the equator in human eyes enucleated some hours after death. The appearance of zonular fibers, as observed by the phase-contrast microscope (Garzino, 1953), is such that it is not surprising that they have been mistaken for branched vitreous fibers. In this connection it is interesting that coarse branching fibers have not been found in vitreous preparations taken from behind the equator or from the center of the vitreous body. The present investigation shows that the vitreous is a colloid in the form of a gel. (6 figures, 11 references)

Orwyn H. Ellis.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Bruna, F. **Experimental study of the action of viruses on the development of the chicken embryo, mainly its visual apparatus.** Boll. d'ocul. **32**:593-622, Oct., 1953.

In a first group, fertilized chicken eggs were inoculated with Newcastle virus, influenza A and B, and herpes febrilis. After an incubation period of 72 hours the embryos were examined under the dissection microscope. A great incidence of marked inhibition of the head development was found in the Newcastle group. The second and eighth nerves were mainly defective, either on one or on both sides. Influenza and herpes virus produced no malformations. A second group of eggs was inoculated with blood from patients with rubella, with scrapings from their pharyingeal mucous membranes, from patients with measles, and with highly diluted herpes febrilis virus. These eggs were allowed to develop until the young broke through. In the rubella series microphthalmos, cataract and iris colobomas were found. (19 figures, 3 tables, references) K. W. Ascher.

Latte, B., and Pino, G. **The appearance of penicillin-resistant strains of staphylococci after local treatment with penicillin ointment.** Giorn. ital. oftal. **4**:343-358, July-Aug., 1953.

The authors give a most interesting review of works on drug resistance of germs, with particular emphasis on the resistance of staphylococci to penicillin, and a long and comprehensive bibliography. In a preliminary approach to the problem they have isolated 85 different strains of staphylococcus from the conjunctiva of trachomatous children who had been given local penicillin therapy for about a week. Forty-five strains showed resistance to the drug. The recognition of the pathogenicity of the germs was based on their ability to coagulate human citrated blood. In a second experiment 180 strains from both conjunctiva and nasal mucosa were examined. While before treatment with local penicillin only 2.5 percent of these strains were penicillin-resistant, two weeks after cessation of local penicillin treatment 62 percent of the strains obtained from the conjunctiva were found to be drug-resistant, and there was no increase in resistance of the strains obtained from the nasal mucosa. The authors dwell on the clinical and epidemiological significance of these and allied phenomena. V. Tabone.

Mori, N. **A study of trachoma virus; a serial passage in rabbit testicle.** Acta Soc. Ophth. Japan **57**:1131-1149, Sept., 1953.

In his previous report (Ibid. 54:346, 1950) the author reported that an inclusion-like finding could be produced in the rabbit testicle, along with an inflammation of the organ, when trachomatous material was inoculated into it, and that a serial passage of the finding was possible. In the present report Mori states that the same finding can be obtained by injection with material of normal rabbit testicle, normal human conjunctiva, rabbit urine and serum. Thus he considers the inclusion like finding to be a nonspecific inflammatory product and concludes that rabbit testicle can not be used as tissue for trachoma virus experiments. (38 figures, 2 tables, 53 references) Yukihiko Mitsui.

Salvi, G. L. **Clinical statistics concerning bilateral retinal detachment.** Boll. d'ocul. **32**:623-633, Oct., 1953.

The data concerning 92 patients with bilateral idiopathic retinal detachment are tabulated as to sex, refractive error, time elapsed between detachment in the first and the second eye, and prognosis of surgery. The prognosis seemed to be worse in the second eye, and the reason for this is discussed. In the whole group the male sex and the higher degrees of myopia preponderate. The majority of detachments in the second eye occurred within five years after the disease appeared in the first eye (graph); more than 20 within one year; 15 times in 2 years; 12 in 3 years, 5 in 4 years, 6 in 5 years.

Detachment in the second eye 6 to 10 years after it occurred in the first one was rare. (references) K. W. Ascher.

Sautter, H. **Hormonal influences on ocular inflammations.** Klin. Monatsbl. f. Augenh. **123**:385-394, 1953.

The author gives a short review of writings on some of the hormones of the anterior pituitary. He assumes an antagonism between the adrenocortical and the somatotropic hormone, following Selye very closely. He assumes a close correlation of these two hormones in infectious diseases and theorizes on their effect on corneal inflammations. (6 figures, 3 references) Frederick C. Blodi.

Taams, G., and Westendorp Boerma, F. **Serological reactions in streptococcal infections applied in ophthalmology.** Nederl. Tijdschr. v. Geneesk. **96**:2342, 1952.

To give the focal infection theory a more scientific base, the authors determined the anti-streptolysin titre, the L and O agglutinations and the modified Rose-test in 120 cases of keratitis, uveitis and scleritis. At the same time an attempt was made to cultivate Streptococcus pyogenes, group A. Streptococci were frequently cultivated from throat or gums in cases of positive L+O agglutination with or without positive modified Rose test or increased anti-streptolysin titre combined with positive O agglutination. In 12 cases in which the eye symptoms had been present, sometimes for years, tonsillectomy or dental extractions or both led to a complete recovery.

G. H. Jonkers.

Tanaka, Ch. **Long-term cultivation of human conjunctiva and an attempt to cultivate trachoma virus in it. A preliminary note.** Acta Soc. Ophth. Japan **57**: 1121-1123, Sept., 1953.

Cultivation of trachoma virus on cultivated human conjunctiva which has been grown in tissue culture was found to be encouraging by the author. A subculture of inclusion bodies was possible in one of her culture series. (5 references)

Yukihiko Mitsui.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Aoki, Y. **Retention of antibiotics in the normal and inflamed cul-de-sac.** Acta Soc. Ophth. Japan **57**:1164-1169, Sept., 1953.

When 1.5-percent ointment of terramycin or aureomycin is applied to the trachomatous conjunctiva, the antibiotics can be demonstrated in the cul-de-sac for as long as four to five hours, whereas in normal conjunctiva they are demonstrable for only three to four hours. No such difference is demonstrable with penicillin and streptomycin. The pH of the normal conjunctival sac is slightly more alkaline than that of the trachomatous conjunctiva. This may be one of the causes of the longer retention of terramycin and aureomycin in the trachomatous cul-de-sac. The unevenness of the trachomatous conjunctiva and a possible affinity of antitrachomatous antibiotics to trachomatous conjunctiva might also play a role. (6 tables, 9 references) Yukihiko Mitsui.

Ashton, N., and Cook, C. **Mechanism of corneal vascularization.** Brit. J. Ophth. **37**:193-209, April, 1953.

The theory of growth-stimulating substances from tissue cells is extensively investigated and the literature reviewed, and one theory postulating an inhibitory factor is discussed. It has also been suggested that the compactness of the corneal tissue is the determining factor in the initiation of neovasculogenesis. Experiments were designed to investigate two questions in corneal vascularization, namely, vascularizing substance and alterations in tissue compactness. Saline extracts were injected and grafting discs from vascularized corneas were grafted into the corneas

of normal eyes. Control experiments were carried out with extracts and grafts from normal corneas; the effects of needle puncture and saline injection were separately controlled. In a second group of experiments attempts were made to decrease the tissue compactness by opening up the lamellae with a fine flattened probe, by injecting nitrogen, saline solution, and serum, and by inducing corneal edema by injurying the corneal endothelium. The experiments failed to demonstrate any significant difference between normal and vascularized corneal extracts, or between normal and vascularized corneal grafts. A reduction in the compactness of the corneal tissue, whether produced mechanically or by the induction of corneal edema, may give rise to vascularization, providing the potential pathways resulting from the stromal separation communicate with the limbal vessels and are maintained sufficiently long. It was shown that destruction of the limbal vessels does not give rise to swelling or opacity in the cornea. Suboxidation or anoxia of the corneal stroma may be a direct stimulus to neovascularization.

The vasoconstrictive effect of cortisone on corneal vessels, which gradually develops and increases as cortisone administration continues, can be readily demonstrated clinically. Cortisone is able to restrain a swelling of the cornea. This action is a potent factor in the inhibition of corneal vascularization by cortisone. Cortisone is able to prevent an increase in capillary permeability and promotes vasomotor tone. (11 figures, 51 references)

Orwyn H. Ellis.

Berardinis, E. **Experimental study of the metabolism of the living retina.** Rassegna ital. d'ottal. **22**:345-360, July-Aug., 1953.

After briefly reviewing the metabolism of living tissues, the author points out that little is known of the metabolism of ocular tissues, especially the retina. The possibility of provoking functional disturbances by injecting enzymatic inhibitors led to experiments on rabbits. The intravenous injection of the iodo-acetate of sodium in doses of 30 to 40 mg. per kilogram resulted in the following changes:—1. marked torpor, even to complete abolition of the pupillary reflex to light, 2. retinal edema, clearing in a few days, but eventually resulting in a form of tapeto-retinal degeneration, 3. destruction of the rods and cones, and finally atrophy of the retina. 4. marked reduction of retinal glucolysis, and 5. increase in glucose and decrease of lactic acid in the vitreous. The particular metabolism of the retina depends principally upon the oxidation of glucose. (6 figures, 30 references)

Eugene M. Blake.

Bianchi, G. **Ganglioplegics in ophthalmology.** Arch. d'opht. **13**:603-608, 1953.

Bianchi discusses the chemical agents having the power to paralyze selectively the synapses of the sympathetic and parasympathetic ganglia, and the role of these agents in ophthalmological therapeutics. He gives the following indications for the ganglioplegics. 1. Acute glaucoma; 2. embolus, spasm, or endarteritis of the central artery of the retina; 3. hypertensive retinopathy; 4. surgical procedures in which hemorrhage is to be feared; 5. herpes zoster, orbital neuralgias, and ophthalmic migraine; and 6. optic neuritis and atrophy. In experimental studies the author utilized the Ciba product 9295 known as Pendiomide which has been studied particularly in general surgery. The preparation effectively blocks the ganglionic synapses of the autonomic system without exerting any action at the level of the effector organs. It does not inhibit the actions of adrenalin or of acetylcholine, both of which, on the contrary, may be reinforced. The resulting paralysis of the autonomic system leads

to a drop in arterial pressure. The product is usually given by the intramuscular route, the intravenous route being reserved for emergencies. In ophthalmology it may be given subconjunctivally or retrobulbarly.

The author reports four cases of secondary glaucoma and two of absolute glaucoma, all of them resistant to other medication, in which retrobulbar injections of Pendiomide had a favorable effect. (6 references) Phillips Thygeson.

Bock, R. H., and Maumenee, A. E. **Corneal fluid metabolism.** A.M.A. Arch. Ophth. **50**:282-285, Sept., 1953.

By use of polyethylene film, rabbit corneas were divided into separate watertight layers. An area of cornea isolated by this method remained clear for 48 hours, thus leading the authors to conclude that osmotic forces acting through the epithelium and endothelium are not solely responsible for the deturgescent state. It was also noted that the limbal vessels alone were not sufficient to maintain the cornea in its normal state. Free interchange between corneal stromal fluid and aqueous is essential. (2 figures)

G. S. Tyner.

Bruna, F. **Influence of sex hormones on healing of experimental corneal wounds.** Boll. d'ocul. **32**:593-622, Oct., 1953.

Folliculin and progesteron, locally administered, accelerated the healing of sterile superficial and penetrating corneal wounds of the rabbit while testosterone delayed the connective-tissue regeneration. (5 figures, references)

K. W. Ascher.

Cagianut, B., and Wunderly, C. **Protein studies on the human vitreous body.** Brit. J. Ophth. **37**:229-233, April, 1953.

Protein studies on the human vitreous body were made using paper electrophoresis and the ultracentrifuge. The albumin is homogenous and is similar to serum albumin; it is 60 to 80 percent of the total protein. This protein component seemed to be increased with increased pressure but the relationship could not be demonstrated. Under pathological conditions the proteins of the vitreous body contain no macroglobulins but only components of normal molecular size. The shape of the curve of the protein of the vitreous body, which shows a smaller absorption than lens protein and retroretinal fluid, corresponds to the large quantity of albumin contained therein. (4 figures, 15 references)

Orwyn H. Ellis.

Davenport, R. C., and Budden, F. H. **Case notes: loss of sight following snake bite.** Brit. J. Ophth. **37**:119-121, Feb., 1953.

A case of complete loss of sight of one eye and the lower half of the field of vision of the other eye is reported. The author believed that a retinal arterial spasm affected one eye, and presumably lasted long enough only in the upper branches of the artery for complete death of the ganglion cells. The spasm in the other eye was of such intensity as to produce total optic atrophy and permanent narrowing of the vessel. Damage to the capillary endothelium due either to the actual lowered blood supply or, as in capillaries elsewhere, to the direct effect of the snake venom, may be the explanation. The scanty literature is reviewed. (6 references) Orwyn H. Ellis.

Doggart, J. H. **Crystals in the anterior segment of the eye.** Tr. Ophth. Soc. U. Kingdom **72**:15-25, 1952.

The presence of crystals in the living eye were first noted in 1828 by Parfait-Landrau and in the anterior segment of the eye by Schmidt in 1831. Crystalline accumulations sometimes furnish a clue to the differential diagnosis. They may emerge as a consequence of trauma, neo-

plasm or inflammation, and in association with degenerative processes. Calcium phosphate crystals are occasionally evident in the cornea as a sequel to lime burns. Isolated crystals may appear in the arcus senilis and arcus juvenilis. Cystine crystals have been found in all layers of the corneal parenchyma in cases of juvenile renal rickets. Cholesterin crystals have been detected in primary lipoid dystrophy of the cornea, trachomatous keratomalacia, keratomalacia from malnutrition and in association with marginal degeneration of the cornea. They are found most often in the anterior chamber. Crystals may develop in a hyphemia or hypopyon. Crystals are frequently found in patients past the age of 60 in the lenses, and tyrosine has been identified in many senile cataracts. They are a prominent feature of cataracts occurring in mongolism, myotonia atrophica, tetany and thyroid deficiency. Secondary glaucoma has been precipitated by crystals in the anterior chamber. Beulah Cushman.

Dorello, U. **Glutathione in the lens-effect of formalin stress.** Giorn. ital. oftal. **4**:330-331, July-Aug., 1953.

Previous work by the author had shown that injection of ACTH and DGA in the rabbit produced decrease of glutathione in the lens, and he had suggested that this might have been a phenomenon of stress. He now reports experiments conducted on six rabbits, given subcutaneous injections of formalin (1 in 100), while six others served as controls. He found no difference in glutathione in the treated animals and the controls, and as formalin is a well-known "stress"-producing agent, he believes that stress has no effect on glutathione in the lens. V. Tabone.

Franceschetti, A., and Habegger, H. **Irgapyrine in ophthalmology.** Ann. d'ocul. **186**:749-759, Aug., 1953.

By mixing equal parts of pyramidon and 30 percent butazolidin, a new compound, Irgapyrine, is obtained, which can be administered parenterally, and which is of great benefit in irritative ocular diseases of various origin (keratitis, scleritis, uveitis, and post-traumatic and post-operative disturbances). It has a therapeutic effect similar to that of cortisone, but with the advantage of being less expensive. It does not present the dangers of treatment with cortisone, which, while it diminishes the inflammatory reactions of an infection, facilitates its propagation. For this reason Irgapyrine is indicated in all acute inflammatory ocular diseases where the etiology can not be established with certainty, and especially where a tuberculous origin is possible. John C. Locke.

Frith, M. L. **Preservation of ophthalmic solutions—a critical evaluation.** Australasian J. Pharm. **33**:836-837 Sept. 30, 1952.

To investigate the preserative and antiseptic properties of substances suitable for use in eye drops the following solutions were chosen: distilled water, hydroxybenzoates (liquor pro guttis B.P.C.), aqua chlorbutol, solutions of cetrimide. Only the cetrimide solutions were bactericidal for the organisms tested. Cetrimide, 1 in 20,000, is suitable as a preservative for ophthalmic solutions, being rapidly fatal to common pathogenic organisms which may contaminate such solutions. In this concentration it is non-irritating to the eye and compatible with most ophthalmic drugs. Ronald Lowe.

Fust, B., Brückner, R., and Studer, A. **The effect of isonicotinic acid hydrazide upon experimental tuberculosis in rabbits.** Ophthalmologica **125**:1-16, Jan., 1953.

Ocular tuberculosis was produced in rabbits by injection into the anterior chamber of a 1:10,000 dilution of a culture of bovine tubercule bacilli. The resultant disease was at first a granulomatous iridocyclitis with marked corneal

involvement, turning later on into a panophthalmitis with generalized tuberculosis. An isonicotinic acid preparation of the name Rimifon was used therapeutically, both topically and systemically, starting one month after the inoculation. Wide variations in the severity of disease prior to the inception of treatment and clouding of the cornea made the evaluation of the results difficult. It appears highly probable that the drug exerted a beneficial influence upon the local as well as the general disease. (1 color plate, 9 figures, 6 references) Peter C. Kronfeld.

Gillian, J. G. **Two cases of unilateral blindness following anesthesia with vascular hypotension.** Canad. M.A.J. **69**:294-296, Sept., 1953.

The use of hexamethonium in surgery to reduce hemorrhage is dangerous. The use of this drug by the anaesthetist, in conjunction with the pressure of a mask or strap pressing on the eye of the patient throughout the operation, is sufficient to cause thrombosis of the central retinal artery. When the systolic pressure drops and the excess of the retinal arterial pressure over the intraocular pressure is reduced, any external pressure on the eye will arrest the circulation and allow occlusion of the retinal arteries. The two cases reported occurred in the left eye.

Herman C. Weinberg.

Guenther, G. **Metachromasy in affections of the host cornea and its correlation to the results of corneal transplantations.** Arch. f. Ophth. **154**:184-196, 1953.

The author applied the procedure described in the preceding paper to 50 corneal discs taken from corneas with keratitis scrofulosa, parenchymatosa, rosacea, dystrophies and injuries. The discs were to be replaced by corneal transplants. In 26 of the 50 cases the corneal parenchyma showed normal or just slightly diminished metachromasy. The same cases gave satisfactory surgical results, and it seems probable that a correlation exists between the amount of chromotropic substance present in the host cornea and the success of the transplantation. (8 references)

Ernst Schmerl.

Guenther, G. **The metachromasy of the human cornea removed after death.** Arch. f. Ophth. **154**:177-183, 1953.

The author follows Ehrlich and defines metachromasy as the quality of certain substances to stain certain tissues in a color different from their own. Methylene blue, toluidine blue and thionin are known for their property of producing metachromatic staining of so-called chromotropic substances. These dyes stain the chromotropic structures pink or red, while the rest of the tissue stains blue. Metachromasy seems especially characteristic of the sulfuric-acid-esters of the polysaccharides, and the present study made use of this observation. The author used toluidine blue and studied human corneas preserved in the refrigerator from one to 36 days. The interstitial tissue and the mast cells showed pronounced metachromasy which constantly diminished with the length of time of preservation. After 30 days of preservation metachromasy could no longer be demonstrated. A decrease in elasticity of the corneal tissue paralleled the decrease in metachromasy. (9 references) Ernst Schmerl.

Hagmueller, K., Hellauer, H., and Spitzy, H. **Absorption of iodine into the anterior chamber after spraying of the corneal surface with spring water containing iodine.** Arch. f. Ophth. **154**:110-124, 1953.

The authors used rabbits for their experiments. In one series of experiments the corneas were sprayed with solutions containing 17.7 mg. percent of iodine. In a second series instillations were applied.

30 minutes after the exposure of the animals to the spraying or the instillations the aqueous showed 0.23 mg. percent of iodine which disappeared within 16 hours. Instillations of hyaluronidase did not change the corneal permeability to iodine. (7 figures, 26 references)

Ernst Schmerl.

Heer, G. **The concentration of chlorides in the blood and aqueous.** Rassegna ital. d'ottal. **22**:415-422, July-Aug., 1953.

On the basis of his analytic results and from observations recorded in the literature Heer holds that the blood-aqueous distribution of chlorides could not be attributed to purely physico-chemical activity but is at least partly determined by a vital activity of cellular energy. (25 references) Eugene M. Blake.

Henkes, H. E., and Rottier, P. B. **The electric response of the human retina to stimulation with monochromatic light.** Ophthalmologica **125**:32-42, Jan., 1953.

In this very extensive study of the b-wave of the electroretinogram in normal individuals the effect of wave length and intensity of the stimulus and of the state of accommodation of the eye examined received particular attention. Under conditions of fairly complete and well sustained dark adaptation a maximum b-wave (about .60 millivolts) was obtained with lights of wave lengths from 365 to 580 millimicrons. For intensities of 20×10^{-4} lumens the relationship between wave length and b-potential was expressed by a roughly plateau-shaped curve. Wave lengths from 480 to 520 millimicrons were most effective in the sense that the smallest intensities (0.3×10^{-4} lumens) caused a maximal b-wave. In addition to the factors mentioned the state of metabolism in the cellular elements of the retina, determined principally by the state of circulation, has important effects upon the electroretinogram. (4 figures, 7 references)

Peter C. Kronfeld.

Ikeda, K. **Some ocular experiments with P^{32}.** Acta Soc. Ophth. Japan **57**:723-728, Aug., 1953.

A rapid but transient appearance of P^{32} in cornea, choroid, retina and sclera occurs when the tracer is injected subconjunctivally into rabbits. It enters the lens and vitreous slightly. Much enters the optic nerve and stays long. In the iris and ciliary body there is a longer retention of the tracer. After subdermal introduction in guinea pigs, P^{32} enters into the eye poorly. Ikeda considers the ratio of P^{32} to total P 48 hours after the introduction of the tracer an index of P-metabolism of the tissue in question. Thus he calculates that in ocular tissues about 0.1 percent of total P-compound is renewed daily while about 1.0 percent is renewed in other organs. The substitution is accelerated by D.F.P. and by physical vibration and impeded by atropine in ocular tissues. There seems to be a barrier between blood or aqueous and lens, retina and uvea, and an electric shock increases the P^{32} content of the aqueous humor, the blood plasma, the pituitary body and the paranephros, and decreases it in the cornea, sclera, retina, brain and leg muscles. (8 figures, 4 tables, 3 references) Yukihiko Mitsui.

Inoue, M. **Biochemical study of experimental diabetic cataract caused by alloxan and dithizone. Second report.** Acta Soc. Ophth. Japan **57**:1008-1017, Sept., 1953.

In an earlier essay (Ibid. 56:588, 1952) the author reported his studies of the development of cataract in rabbits with experimental diabetes caused by alloxan and dithizone. In the present report he states that a combined administration of vitamin C with vitamin B_2 and KCl not only impedes the development of such cataract but also reduces the already developed opacity of the lens. (11 figures, 4 tables, 4 references)

Yukihiko Mitsui.

Jaeger, Wolfgang. **The dehydrogenase system of the cornea.** Arch. f. Ophth. **154**: 142-164, 1953.

The purpose of this series of experiments is the investigation of the dehydrogenase system of the cornea and the normal corneal metabolism. The author plans to study the corneal citric acid cycle and he also intends to examine the action of toxic substances and drugs upon the corneal enzymes. In the present study the hydrogen activated by the dehydrogenase is experimentally retained by the hydrogen acceptor triphenyltetrazoliumchloride (TTC). TTC is reduced by hydrogen and forms red triphenylformazan. The latter can be quantitatively determined by photometry. TTC was applied to beef corneas under a number of experimental conditions. The corneal epithelium showed the presence of dehydrogenases for the breakdown of glucose, pyruvic acid, lactic acid, citric acid and succinic acid. In the corneal parenchyma and endothelium the enzymes appeared in smallest quantities only. The addition of citric acid or glucose increased the dehydrating processes by 10 to 30 percent. Exposure to a temperature of 65° C inactivated the corneal dehydrogenases. The optimum pH was found near 7.4. The final breakdown of lactic acid and pyruvic acid seems to depend on the efficiency of the dehydrogenases.

Ernst Schmerl.

Kahán, A., Koritsánszky, D., and Mándy, E. **A new menstruum for ophthalmic ointments.** Szemészet **2**:71-76, 1953.

The new substance is a paraffin mixture of equal parts of unguentum paraffini and olium paraffini containing 3 percent glycerol monostearate as emulsifier. The ointments prepared with this menstruum mingle readily with tears. The emulsion ointments containing 10 percent water have a greater readiness to detach their effective principle than have the substances employed hitherto for ophthalmic ointments. This readiness can be increased by a dressing applied to the eye, whereas the effect of the other ointments decreases on dressing. Penicillin ointments destined for the eye should be made without water. Gyula Lugossy.

Kinsey, V. E. **Comparative chemistry of aqueous humor in posterior and anterior chambers of rabbit eye.** A. M. A. Arch. Ophth. **50**:401-417, Oct., 1953.

Although similar in many respects, differences were found in the composition of the aqueous of the anterior and posterior chambers of rabbit eyes. The two fluids differ mainly in the concentration of various anions and nonelectrolytes. Certain deductions were made from these observations. 1. The lower concentration of chloride and phosphate existing in the posterior aqueous is compatible with the idea of a diffusional exchange between ciliary body and posterior chamber. 2. The higher concentration of bicarbonate and ascorbate in the posterior aqueous provides evidence in favor of secretion of these substances by the ciliary body. They serve to control the concentration of other electrolytes. Comparative studies were made of the concentrations of chloride, bicarbonate, lactate, ascorbic acid, phosphate sodium, potassium, carbon dioxide, nonprotein nitrogen, urea, and glucose. The osmotic pressure of the two fluids was the same. (1 figure, 13 tables, 20 references) G. S. Tyner.

Kirisawa, N., and Sekiguchi, K. **Harmful effect of antibiotics and chemotherapeutic agents on the eye.** Acta Soc. Ophth. Japan **57**:969-971, Aug., 1953.

The authors consider an increase in protein concentration in the aqueous 24 hours after the introduction of a drug into the anterior chamber as an indication of the degree of harmful effect of the drug. Erythromycin and chlortetracyclin damage the eye greatly, strepto-

mycin, chloramphenicol and oxy-tetracyclin moderately, and sodium-para-aminosalicylate and penicillin mildly. They consider the following concentrations to be the limit for intra-ocular administration: penicillin 100,000 U/cc., streptomycin 50 mg./cc., oxytetracyclin 5 mg./cc. and chlortetracyclin 1 mg./cc. (2 figures, 5 tables, 4 references) Yukihiko Mitsui.

Kodama, J. **Damage of the eye by silicon ester.** Acta Soc. Ophth. Japan **57**:965-969, Aug., 1953.

Kodama observed the massive occurrence of a keratoconjunctivitis among workers in a $Si(OCH_3)_4$ factory. He applied the substance, either as a drop or as a gas, into rabbit eyes and brought about a severe keratoconjunctivitis for 7 to 10 days. No remedy relieved the eye once the agent was applied. (5 references) Yukihiko Mitsui.

Kojima, K., and Nagao, Y. **Histochemistry of the retina.** Acta Soc. Ophth. Japan **57**:1253-1263, Oct., 1953.

In the first part of this paper the authors report their histochemical studies of the action of hyaluronidase on the frog retina and other parts of the eye. When the ferment was introduced subdermally a disappearance of glycogen resulted in the retina in one hour. Phosphatase in the retina became less active. The loss of glycogen was brought about in vitro when a section of cornea was brought into contact with hyaluronidase for 17 hours at 37°C. They further describe the difference in the action of hyaluronidase on light and dark-adapted retina, as well as the effect of hyaluronidase on other elements of the retina as polysaccharides.

In the second part they describe the chemical structure of the retina as revealed by toluidine blue and Rinehart staining. Distribution of the substances in the retina of various animals positive for these stainings is described in detail. The nature of the substance is still not definitely known but they suppose it to be an acid polysaccharide. (4 tables, 30 references) Yukihiko Mitsui.

Kornblueth, W., Yardeni-Yaron, E., and Wertheimer, E. **Glucose utilization of the retina.** A. M. A. Arch. Ophth. **50**: 500-505, Oct., 1953.

This is the second of two articles on the subject. This report deals with the influence of a variety of hormones and endocrine deficiencies on glucose utilization of the retina. Albino male rats were used as experimental animals. The experiments indicated that glucose utilization of the retina was unaffected by these agents. In this regard, the retina is a unique tissue. All other tissues are affected. (18 references) G. S. Tyner.

Langham, Maurice. **Observations on the growth of blood vessels into the cornea. Application of a new experimental technique.** Brit. J. Ophth. **37**:210-222, April, 1953.

A method of inducing a swelling and subsequent growth of vessels into the cornea was devised Injection of a neutralized solution of the organic compound alloxan into the anterior chamber can be used to initiate a completely reversible swelling of the cornea. In injections with low concentrations of alloxan no generalized vascularization of the cornea was observed. With the return of the main mass of the cornea to normal thickness, the blood in those newly-formed vessels which had developed, slowly disappeared leaving an apparently normal cornea. When the concentration of alloxan was raised, a swelling of the cornea to two and a half or three times normal followed by a profuse vascularization was observed. With the subsequent invasion of the cornea by new vessels, no significant reduction in corneal swelling was noted, although much later, between the sixth

and thirteenth week, the thickness very slowly returned to nearly normal. After injection, the initial drop in concentration of lactic acid caused by an inhibition of corneal glycolysis is suggested by the return of the concentration of lactic acid to normal after 24 to 28 hours, at which time corneal swelling has become very marked. Alloxan does cause an initial inhibition of glycolysis, which is reversed with the disappearence of alloxan from the cornea. With the growth of new vessels into the cornea, the concentration of lactic acid dropped again, an effect which may well be due to a more easy and rapid loss into the circulating blood. The inhibition of respiration was shown to be reversible. Gross changes in the permeability of the corneal tissue and of the capillary endothelium lining the limbal vessels of the cornea were studied, using the water-soluble vital dye Pontamine sky blue. After the administration of alloxan into the aqueous humor and after corneal swelling, an increase in permeability of the walls of the capillary limbal vessels occurred, as was indicated by a diffusion of the dye into the mass of the cornea. (5 figures, 21 references)

Orwyn H. Ellis.

Laval, Joseph. **Use of hydrocortisone (hydrocortone) acetate in ophthalmology.** A.M.A. Arch. Ophth. **50**:299-302, Sept., 1953.

Hydrocortone when applied topically may be used in conjunction with systemic cortisone. Hydrocortone alone may be more efficacious than cortisone when used topically in selected cases. G. S. Tyner.

Lowenstein, O., and Loewenfeld, I. E. **Effect of physostigmine and pilocarpine on iris sphincter of normal man.** A.M.A. Arch. Ophth. **50**:311-318, Sept., 1953.

The authors are not in agreement with the idea that physostigmine and pilocarpine are competitive when used in combination. They present evidence to the contrary and believe that the effect of the combined use of these drugs as miotics is additive. Their combined effect is greater than when used singly. According to their observations pilocarpine does not decrease the ability of the iris sphincter to respond to acetylcholine. (3 figures)

G. S. Tyner.

Michiels, Jean. **Antibiotics other than pencillin, in ophthalmology.** Ann. d'ocul. **186**:617-636, July, 1953.

The methods of administration and indications for the newer antibiotics, in ophthalmology, are reviewed.

John C. Locke.

Mizukawa, T., Takagi, Y., Suzue, T., and Kishimoto, S. **Cortisone in ocular allergy. A study of its mode of action.** Acta Soc. Ophth. Japan **57**:1067-1073, Sept., 1953.

Cattle serum was injected into the anterior chambers of rabbits sensitized to the same serum. Protein content of the aqueous, eosinophile content of the blood stream, ascorbic acid (reduced form) in ocular tissues, the activity of cholinesterase in the choroid, and the fraction of serum protein were measured in these rabbits. There was a considerable increase in their aqueous protein and of the eosinophiles in the blood. Cortisone given subconjunctivally impeded the increase slightly. Cortisone given locally also impeded a reduction in ascorbic acid in the eye considerably. This is characteristic of the Arthus reaction, although cortisone is apt to decrease ascorbic acid in the normal rabbit eye. In the Arthus reaction there is a reduction in the ratio of albumin to globulin in the serum, and an increase in gamma globulin, but these changes are impeded by cortisone, administered locally. A systemic use of cortisone seems to change the Arthus reaction. It does not impede the decrease of the ratio of al-

bumin to globulin and the decrease in ascorbic acid, and it increases alpha-globulin and decreases gamma-globulin in the serum. (7 figures, 8 references)

Yukihiko Mitsui.

Mueller H. K., and Kleifeld, O. **Paper electrophoretic studies of the phosphorus metabolism of the lens using radioactive phosphor.** Arch. f. Ophth. **154**:165-176, 1953.

A number of years ago Mueller showed that the intake of sugar by the lens depends upon enzymatic processes and a phosphorylization of the carbohydrate. Oxydations and the adenylic acid system seemed to play a major role in the phosphorylization and the transportation of the sugars. The authors felt that other substances might enter the lens by similar processes. With the help of a paper electrophoretic method (described by Schild and Maurer in Biochem. Ztschr. 323:235, 1952), they studied the uptake of P^{32} by the various phosphate fractions of the lens. The lenses of rabbits, calves, pigs and men showed definite similarity of their electrophoresis diagrams. Three maxima were found, and the authors feel that these maxima can be ascribed to the uptake of P^{32} by the adenosintriphosphoric acid and those phosphate fractions which have practically no hydrolizing qualities. The exchange of P^{32} in the inorganic phosphate and the adenosintriphosphoric acid seems to decrease with the age of the rabbits. An increase of the P^{32} uptake was found in the fraction of the less hydrolizable phosphate of older rabbits. (7 figures, 7 references)

Ernst Schmerl.

Muenich, William. **The proteins of the rabbit's aqueous studied with the help of paper electrophoresis.** Arch. f. Ophth. **154**:50-57, 1953.

Paper electrophoresis was used to demonstrate the presence of proteins in the aqueous and serum of rabbits. Proteins could not be found this way when less than 0.01 cc. of primary aqueous were studied. The same amount of secondary aqueous, however, showed the presence of larger quantities of albumins and smaller quantities of α-, β- and γ- globulins. Secondary aqueous also showed the albumins increased in comparison to blood serum, while the β-globulins seemed comparatively decreased. Following intravenous or intramuscular injections of pyrifer, albumin could be demonstrated in the primary aqueous. (2 figures, 30 references)

Ernst Schmerl.

Nagata, N. **A comparison of aqueous humor with spinal fluid in normal rabbits.** Acta Soc. Ophth. Japan **57**:764-767, Aug., 1953.

The aqueous and the spinal fluid contain the same amount of protein in the rabbit. When 10-percent ovoalbumin is introduced intravenously it enters into the spinal fluid, but not into the aqueous. However, after a puncture, in the normal rabbit protein enters in a great amount into the aqueous but not into the spinal fluid. The author considers the paradoxical phenomenon to indicate that in physiologic conditions the blood-aqueous barrier is tighter than the blood-spinal fluid barrier, but the former is more easily loosened than the latter by physical influences such as a puncture. Warburg's test indicates that after a puncture a considerable decrease in oxygen uptake results in the ciliary body but not in the choroid plexus. The aqueous and the spinal fluid have different modes of origin. (12 references)

Yukihiko Mitsui.

Ogino, S., Mishima, I., and Soya, T. **Decomposition of ascorbic acid in cataractous lens.** Acta Soc. Ophth. Japan **57**: 1310-1311, Oct., 1953.

In the previous essay (Ibid. 55:43, 1951) the authors reported that in trau-

matic cataract a decomposition of ascorbic acid to diketo-gulonic acid was confirmed. In the present experiment they demonstrated that in the normal lens of the rabbit there was no oxalic acid, but that it appeared six days after traumatism. They believe therefore, that diketo-gulonic acid would be decomposed to oxalic acid. (1 figure, 1 table, 11 references)

Yukihiko Mitsui.

Pillat, B., and Powers, M. M. **Epinephrine and arterenol determinations in aqueous humor and iris and ciliary body of cattle.** A.M.A. Arch. Ophth. **50**:323-330, Sept., 1953.

This is a report of investigations undertaken to demonstrate the presence of norepinephrine and epinephrine in the anterior uvea and aqueous. The methods of extraction and bioassay are described. The results indicate a very low concentration of norepinephrine in the anterior uveal tissue. The authors postulate therefore that the supply of adrenergic nerve fibers in these tissues is small. The presence of epinephrine could not be demonstrated. Neither substance could be demonstrated in aqueous humor of cattle eyes. (4 figures) G. S. Tyner.

deRoetth, A., Jr. **Respiration of the ciliary processes.** A. M. A. Arch. Ophth. **50**:491-499, Oct., 1953.

These experiments were conducted on 800 beef eyes. Preparations of beef ciliary processes showed a 100-percent increase in respiration when in 100-percent oxygen as compared to air. It is assumed from these experiments that 100-percent oxygen represents a more normal environment than air and that the marked effect of high oxygen tension on respiration might be due to the ability of the ciliary body to secrete oxygen. (4 figures, 12 references)

G. S. Tyner.

von Sallmann, Ludwig. **Physiologic chemistry of the eye.** A. M. A. Arch. Ophth. **50**:514-539, Oct., 1953.

The pertinent literature is reviewed. (100 references) G. S. Tyner.

Sannella, L. S. **An early symptom of streptomycin neurotoxicity.** A.M.A. Arch. Ophth. **50**:331-332, Sept., 1953.

Two patients with tuberculosis, one receiving streptomycin and the other dihydrostreptomycin, noted an illusory movement of objects in the visual field associated with movement of the head. The author believes this is an early sign of streptomycin toxicity. G. S. Tyner.

Schubert, E. **The retinal trigger mechanism releasing optic nerve activity.** Arch. f. Ophth. **154**:120-134, 1953.

The author studied some phases of the electrical activity of the retina and optic nerve, using narcotized cats. He summarizes the findings of this rather technical study the following way. In scotopic vision the b-wave of the electroretinogram does not act as generator potential of the activity of the optic nerve. When the illumination of the eye is varied the electrotonic potentials of the optic nerve do not show any correlation to the b-wave with respect to amplitude and time factor. In photopic vision neither the electroretinogram nor intraretinal leads point to an electrotonic potential as a generator potential. According to these findings the electric activity of the optic nerve is probably not released by an electrotonic mechanism. The retinal ganglia cells seem to be activated synaptically by spike potentials of the afferent neurons. (5 figures, 13 references) Ernst Schmerl.

v. Studnitz, G. **Increase of the dark adaptation by "Helenien" and vitamin A emulsions.** Arch. f. Ophth. **154**:137-141, 1953.

In a short note v. Studnitz rejects the negative findings published by Glees and

his co-workers in Arch. f. Ophth. 153: 188, 1952. (6 references) Ernst Schmerl.

Sztrilich, L. **The use of aureomycin in ophthalmology, especially in the treatment of trachoma.** Klin. Monatsbl. f. Augenh. **123**:351-356, 1953.

Fifty patients were treated; 42 had trachoma and could be cleared of any secondary infection after 5 to 7 days of topical treatment. (12 references)

Frederick C. Blodi.

Ther, L., and Muegge, F. **A new surface anesthetic (cornecain).** Arch. f. Ophth. **154**:244-252, 1953.

Cornecain (Farbwerke Hoechst 12303) in customary concentrations is said to produce a prolonged anesthesia without affecting the pupil, the ocular tension and the ocular tissues. (3 figures, 5 references)

Ernst Schmerl.

Toshima, K. **Acetylcholin metabolism in the visual paths.** Acta Soc. Ophth. Japan **57**:830-835, Aug., 1953.

In the cat the content of acetylcholin precursor in the retina, optic nerve, primary optic ganglia and visual area of the cortex is 4.0, 0.5, 3.0 and 2.0 γ/gm. respectively by Straub-Yagi's method, and cholinesterase in one gram of these tissues hydrolyses 70.6, 10.8, 60.8 and 19.5 mg. of acetylcholin in one hour at 37°C respectively. The ferment in the visual paths proved to be specific cholinesterase. Toshima further demonstrated cholinacetylase in these tissues by Nachmansohn's method, using aceton-powder of the tissues. The amount of acetylcholin produced from one gram of the powder of retina, primary optic ganglia and visual area of the cortex is proved to be 384, 400 and 428 γ respectively. (6 tables, 18 references)

Yukihiko Mitsui.

Wybar, K. C., and Campbell, F. W. **The influence of cortisone on corneal vascularization in the guinea pig and in the rabbit.** Tr. Ophth. Soc. U. Kingdom **72**: 105-118, 1952.

The action of cortisone on wound healing and on new vessel formation in the cornea of the guinea pig and in rabbits was studied after standard heat injuries were inflicted on the corneas of guinea pigs and rabbits. The intraperitoneal administration of cortisone to guinea pigs caused a delay in the rate of epithelization and in stromal regeneration which also prolonged the diminution of vascularization of the cornea. The subconjunctival administration of cortisone similarly prolonged the vascular response. The subconjunctival administration of cortisone in rabbits produced a well marked diminution of new vessel formation within the cornea. (2 figures, 6 tables)

Beulah Cushman.

Yamada, Y. **A biochemical study of cataract caused by administration of sodium butyrate and tyrosine in guinea pigs with vitamin C deficiency.** Acta Soc. Ophth. Japan **57**:1004-1007, Sept., 1953.

In guinea pigs with vitamin C deficiency, 250 mg. of sodium butyrate per day was administered intraperitoneally. From the seventh day 500 mg. tyrosine was given orally daily with the sodium butyrate. Five days thereafter, there was constant development of cataract. In these animals there was an excretion of a considerable amount of benzoquinone acetic acid in the urine. Without sodium butyrate there was neither a development of cataract nor the excretion of a large amount of benzoquinone acetic acid. (1 figure, 10 references)

Yukihiko Mitsui.

Yoshizawa, K. **Glycogen in the retina.** Acta Soc. Ophth. Japan **57**:783-797, Aug., 1953.

The distribution of glycogen in the retina is studied histochemically in sections

of frog, chick and snake eyes prepared by a freezing dehydration method. The cone myoid contains the greatest amount of glycogen. The glycogen decreases in dark adaptation. The decrease is greater in rod retina than in cone retina. Such substances as potassium cyanide and monoiodoacetic acid, which impede the reconstruction of visual purple, also impede the decrease of glycogen by dark adaptation. The author considers that the glycogen is stored in the cone myoid and supplies energy to the rods in the reconstruction of visual purple. The presence of the Bauer-Feulgen-reaction-positive substance in the external part of the rods and the presence of magnesium and potassium in the rods indicate the possibility of this postulate. He further describes the distribution of glycogen in the choroid and the changes in quantity induced by various factors. (8 figures, 9 tables, 45 references) Yukihiko Mitsui.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Alpern, M., and Benson, D. J. **Directional sensitivity of the pupillomotor photoreceptors.** Am. J. Optometry **30**:569-580, Nov., 1953.

Experiments were performed on three emmetropic young men showing that the stimulus to foveal cones from a narrow beam of light through the center of one pupil had a greater consensual pupil constrictor effect than stimuli to the same cones from the same beam entering the edge of the pupil. The consensual pupil was photographed under infra-red light, and the negatives used for comparative measurement with the stimulus beam in various parts of the other pupil. The curves of absolute light sensitivity in the Stiles Crawford phenomenon correspond well to the data presented here from pupil response. The simple conclusion would be that a foveal cone has approximately equal sensory and pupillomotor function. Spring and Stiles, 1948, found no change in pupil reflex from the beam in various parts of the pupil. Paul W. Miles.

Coates, W. R. **Foveal targets.** Brit. J. Physiol. Optics **10**:169-174, Oct., 1953.

Cures by orthoptic treatment usually occur in intermittent heterotropias of small degree. This agrees with Scobee's theory that squint begins with foveal suppression and advances to macular suppression. Orthoptic treatment would be more successful if children were brought for examination before the age of two years, and if then fusion training were done with targets so small that only the foveas are stimulated. Peripheral fusion should not be ignored because it is involved in the phenomenon of retinal slip which occurs in all cases of heterophoria. In the present instruments for testing and treatment there is little concern as to whether peripheral or central fusion is involved.

Paul W. Miles.

Ellerbrock, V. J. **The prescription of visual training by a graphical method.** Am. J. Optometry **30**:559-568, Nov., 1953.

This is a mathematical discussion of the effect of orthoptic instruments like the stereo-disparator to stimulate certain amounts of accommodation and convergence at the same time. This can be correlated in graphic form to the specific needs of individual patients.

Paul W. Miles.

Harrison, E. R. **Visual acuity and the cone cell distribution of the retina.** Brit. J. Ophth. **37**:538-542, Sept., 1953.

In 1941 Polyak and also Ludvigh described the acuity gradient of the visual field and its relation to the structure of the retina with particular emphasis on relationship of vision to size and separating intervals of the cones, as well as the ratio of the number of cones to that of the

optic nerve fibers. This ratio was graphically illustrated by a series of curves which were very similar in the two studies. A surprising feature of the curves is that the curve of visual acuity has a point of intersection with the curve of cone distribution; this necessitates some revision of the estimates of minimum perceptible visual angle. This has not yet been satisfactorily elucidated but further refinements in techniques should yield true measurements. (4 figures, 12 references) Morris Kaplan.

Hughes, H. **An investigation into ocular dominancy.** Brit. J. Physiol. Optics **10**:119-143, Oct., 1953.

This lengthy discussion confirms most of the studies relating to the dominance of hand, eye, and speech centers which have been done in the past. The high incidence of speech and reading difficulties in those with left dominance or with crossed dominance and the difficulty left dominant individuals have in the modern machinery and social habits is emphasized. A new test for ocular dominance is described which is so simple it should be of value clinically. A vertically acting prism is placed before one eye, and the subject is asked which image seems more steady. The steady image indicates the dominant eye.

Hughes makes a new observation that persons who are by the tapping test found to be left handed may declare that they have always been right handed. The subject makes as many spots on a post card as possible in ten seconds. The hand which does this most rapidly and best is dominant.

Nearly every person has a dominant eye; equally mixed dominance is rare. If the dominant eye is hindered by new glasses or by an injury there will be much more distress than in similar hindrance to the recessive eye. Routine tests for heterophoria differ with the eye fixing, and the test most prognostic clinically is done with the dominant eye fixing. There is no difference in amplitude of accommodation in the dominant and the nondominant eye. Paul W. Miles.

Junès. **Optogeometric considerations on corrective lenses used in spherical ametropia and presbyopia.** Ann. d'ocul. **186**: 820-842, Sept., 1953, and 918-942, Oct., 1953.

The author reviews well known geometric optical considerations pertaining to the use of corrective lenses in spherical ametropia and presbyopia.

John C. Locke.

Kephart, N. C., and Unger, R. M. **An investigation of visual performance among selected groups of school children.** Am. J. Optometry **30**:635-643, Dec., 1953.

Noncycloplegic retinoscopic findings of 40 grade school children living on farms were compared to those of 40 children of similar age living in the suburb of a city. The average refractive error of the city children was —0.60 diopters, while that of farm children was zero. Tests of refraction at the beginning and at the end of a school year showed more myopia after a term of school. These findings do not agree with published reports under cycloplegic examination of thousands of children. Paul W. Miles.

Lavery, F. S. **Cases fitted with molded corneal lenses (corneal caps).** Tr. Ophth. Soc. U. Kingdom **72**:261-264, 1952.

The author has found that molded corneal caps have several advantages over contact glasses, among them the ease of insertion and removal, and usually greater tolerance. They do not make the eyes seem larger and rarely does veiling of the cornea occur because the corneal cap permits oxygenation of the corneal epithelium and free circulation of tears.

Beulah Cushman.

Miles, P. W. **Anomalous binocular depth perception due to unequal image brightness.** A.M.A. Arch. Ophth. **50**:475-478, Oct., 1953.

A new anomaly of binocular depth perception due to unequal image brightness is described and named "anisodominance." If a pair of objects appears relatively brighter or larger to the right eye than they do to the left, the right of the two objects appears nearer. Thus, for example, a formation of ships or aircraft moving obliquely in step formation may appear to be moving in a straight line. (1 figure, 6 references) G. S. Tyner.

Pacalin, G. **The acquisition of depth perception, considered chiefly as a function of convergence and of physiologic diplopia.** Ann. d'ocul. **186**:602-616, July, 1953.

Depth perception is not innate, but is acquired by practice and habit. The sensations produced by convergence effort and by physiologic diplopia are projected by consciousness, with the help of memory. For every point in space, there is a corresponding effort of convergence. A sensation of this effort is transmitted to consciousness by a proprioceptive route, leaving in memory the recollection of this point. This recollection allows us, when we converge again, to determine the position in space of the object at which we are staring.

To understand the action of physiologic diplopia, one should consider an object behind or in front of the one being fixed. If in front of the fixed object, it is projected (by parallactic displacement) by each eye, to the opposite side, and if behind the fixed object, to the same side. When both eyes are open, the diplopic sensation, characterised by the form of the diplopia and the distance between the images, evokes in memory the recollection of a frontal plane in space, to which consciousness is projected. John C. Locke.

Pascal, Joseph I. **The truth about "false" torsion.** Ophthalmologica **125**:190-196, March, 1953.

True torsion is a wheel-like rotation of the eye on an anteroposterior axis. During true torsion corresponding corneal and retinal meridians rotate in the same direction. False torsion is an inclination of the corneal and retinal meridians occurring as an unavoidable component of rotation of the eye on an oblique axis in Listing's plane. The direction of this inclination is opposite for corresponding corneal and retinal meridians. (4 references) Peter C. Kronfeld.

Richter, M. **Recent developments in the examination of the color sense.** Brit. J. Physiol. Optics **10**:155-166, Oct., 1953.

This is a short review by a Berlin physicist on instruments for testing the color sense. Such tests have become more quantitative in recent years, and with increasing knowledge terms like "red-green blindness" are becoming obsolete. The Ishihara test is considered a good one, although it is qualitative and must be used under daylight. Under incandescent lighting the deuteranomalous person would be found normal. The anomaloscope is a quantitative instrument which is so sensitive that variations in the color sense of normals and abnormals can be shown to vary from winter to summer. In the United States, such instruments are considered inconvenient. Color blindness is now considered to be an absence or reduction of spectral sensitivity or a shift of maximum spectral sensitivity.

Paul W. Miles.

Ridley, Frederick. **Some reflections on visual perception.** Tr. Ophth. Soc. U. Kingdom **72**:635-655, 1952.

In part one, the author reflects on visual perception, the visual pathway, and the capacity to preserve the spatial ordering of the image formed on the retina, and

the modifications through physical and mental causes. In part two, consideration of the nature of perception leads to the conclusion that the visual apparatus and its related cortex are sufficiently vast, complex and co-ordinated to account for the phenomena of perception, visual thinking and memory. In part three, the author shows that the mental phenomena occur in space and time, which are not to be identified with physical space-time, and concludes that matter is inferred and the qualities which we attribute to the world around us are mental. In part four, he discusses the fundamental significance of pattern as applied to percepts and to perceptual thinking. In part five, communication of percepts to others by spoken and written language is considered. In part six, the links between mental and physical activity are considered, and he concludes that the relationship is such that perceptual thinking and mind may have an independent existence outside physical space-time. Beulah Cushman.

Rushton, W. A. H. **Chemical and nervous factors in dark adaptation.** Tr. Ophth. Soc. U. Kingdom **72**:657-664, 1952.

The retinal factors upon which sensitivity during dark adaption depends are: 1. the number of quanta which fall on the retina, 2. the number of stimulated rods which converge upon the same final common path, 3. the duration of the flash, and 4. the critical number of quanta which are absorbed within the time upon the limited area. Beulah Cushman.

Siebeck, Robert. **Simplified constructions for the calculation of obliquely crossed cylinders and prisms.** Arch. f. Ophth. **154**:8-17, 1953.

Geometric optical calculations to obtain the values of obliquely crossed cylinders and prisms by the use of the parallelogram of forces are discussed. (6 figures, 10 references) Ernst Schmerl.

Sorsby, A., and Sheridan, M. **Changes in the refractive power of the cornea during growth.** Brit. J. Ophth. **37**:555-557, Sept., 1953.

In the newborn human infant the length of the eye measures around 16 mm., whereas the adult eye is 24 mm. long. This change in axial length should produce a change in refraction of some 20 to 30 diopters and yet normally little change occurs during growth. It follows that there must be changes in the individual components of total refraction, which would compensate for the change in length. Studies were carried out on rabbits in which the results of retinoscopy were correlated with measurements of corneal curvature. In the rabbit, as in man, relatively little change in refraction occurs. In the adult rabbit, the average radius of corneal curvature is 7.7 to 8.0 mm. which amounts to a refractive power of around 43 diopters. In the six weeks old animals the radius of curvature measured around 5.5 mm. with a refractive power of 60 diopters. While the length of the eye changed to produce a "growth myopia" of about 15 diopters, the cornea assumed a new curvature, equivalent to about 15 diopters of hyperopia. (4 graphs) Morris Kaplan.

Starkiewicz, Witold. **Changes of refraction of the eye due to changes in the depth of the anterior chamber.** Klinika Oczna **23**:81-90, 1953.

Refraction of the eye changes when the depth of the anterior chamber is changed. The cardinal points of the optic system move forward when the lens is closer to the cornea and the refractive power of the system is increased. The refractive power is decreased when the anterior chamber becomes deeper. The author presents a number of formulas illustrating his statements and introduces the definition of a frontal refraction. It is related to the distance between the cornea and the focus of

far vision. Two cases are presented where the anterior chamber was shallow because of glaucoma. After treatment the chamber increased in depth and it became necessary to increase the power of convex lenses. (6 references) Sylvan Brandon.

Umetani, S. **Influence of illumination upon the power of accommodation.** Acta Soc. Ophth. Japan **57**:1321-1324, Oct., 1953.

An obvious increase in the power of accommodation, an approach of the near point, was brought about by an increased intensity of illumination. That miosis was a factor was excluded in this experiment by the use of an artificial pupil. The author believes that high illumination accelerates the accommodation. But the best illumination for the highest accommodation was not constant and was in the range of 100 to 1,500 lux. (2 figures, 13 references) Yukihiko Mitsui.

5

DIAGNOSIS AND THERAPY

Arkin, V. **The magnification attainable by direct ophthalmoscopy.** Ophthalmologica **125**:124-133, Feb., 1953.

A telescopic attachment to a European type of electric ophthalmoscope is described. The effect of this attachment upon the size of the ophthalmoscopic image is illustrated in simple ray-tracings of the effects of correcting lenses upon image size in ametropic eyes. (9 figures)
Peter C. Kronfeld.

Bahn, G. C., Brown D. V. L., and Fleck, H. **Restraining device for ophthalmoscopic and biomicroscopic examination of small primates.** A.M.A. Arch. Ophth. **50**: 344-345, Sept., 1953.

A restraining device for small animals is described and pictured. It provides immobilization of the head and body to facilitate ocular examination. (2 figures)
G. S. Tyner.

Bietti, G. B. **The result of audiometric examinations in some ocular diseases.** Tr. Ophth. Soc. U. Kingdom **72**:343-355, 1952.

The author calls attention to the diseases of the ear often associated with visual disturbances. He mentions interstitial keratitis in which there is loss of hearing with diminution of the auditory field especially for high notes and impaired aerial transmissions. Some types of uveitis are associated with aural changes, particularly sympathetic ophthalmia, and uveitis linked with pigmentary disturbances and dysacusia such as the Vogt-Koyanagi and Harada syndromes. Other ocular diseases are van der Hoeve syndrome in which there is bone fragility, blue sclera and otosclerosis, Cogan's syndrome of non-syphilitic keratitis with Ménière-type disturbances and finally retinitis pigmentosa, toxic amblyopia, and glaucoma which may be accompanied by auditory disturbances. In tapeto-retinal degenerations the findings indicate that there are simultaneous and etiologically similar degenerative processes in the retina and the cochlea which may be a congenital abiotrophic process in the ocular and aural neuroepithelium. (13 figures)
Beulah Cushman.

Bloch, E. H., and Petry, S. H. **A new camera for cinephotomicrography.** A.M.A. Arch. Ophth. **50**:346-351, Sept., 1953.

A modification of the Eastman Cine-Kodak 16 mm. camera is described and pictured. It was designed to record the circulation in the human bulbar conjunctiva and was found effective in recording the microscopic circulation in other tissues and organs. (4 figures)
G. S. Tyner.

Colenbrander, M.-C. **Prism for examination of the iridocorneal angle.** Ann. d'ocul. **186**:452-456, May, 1953.

The author describes a prismatic contact lens for gonioscopy, which has the

following advantages: 1. the application requires no manual skill; 2. the image is not reversed by reflection, and orientation is easy; 3. one can see three sectors of the anterior chamber simultaneously; 4. a shallow chamber can be examined stereoscopically in all directions; and 5. the prism may be utilized for goniotomy. (3 figures) John C. Locke.

Foster, John. **The optical control of sharp ophthalmic instruments.** Tr. Ophth. Soc. Australia **12**:170-181, 1953.

The sharpness of a knife edge is best determined by microscopy using vertical illumination. Objectives giving ×80 are adequate for cataract knives. Holders are described that ensure protection of point and edge of cataract knives and keratomes. Illustrations show good and faulty points. Many new instruments show spots of corrosion sufficient to lead to rejection. Corrosion is the chief cause of reduction of sharpness during sterilisation. Boiling is safest for sterilisation. The edges of sharp instruments may be protected in storage by dipping in "AC.10" (a mixture of paraffins, naphthenes and petroleum sulphonic acids). Use of "AC .10" allows boiling without corrosion.

Ronald Lowe.

Foster, John. **Table viewer as an aid to clinical demonstration.** Brit. J. Ophth. **37**: 251-252, April, 1953.

An instrument similar to a Kodaslide table viewer is used for projecting colored slides for easy demonstration of illustrations to groups of students. (1 figure)

Orwyn H. Ellis.

François, J., and Verriest, G. **Campimetry in the dark.** Ann. d'ocul. **186**:695-727, Aug., 1953.

The authors employed quantitative scotopic campimetry with the help of Livingston's test objects, having constant diameters and progressive brightnesses. They studied 15 young normal emmetropic subjects. The average size of the scotopic central scotoma varied inversely with the brightness of the test object and directly with the rod threshold. The determination of the peripheral isopters was very difficult because of the lack of gradients in this region. John C. Locke.

Gordon, D. M., McLean, J. M., and Koteen, H. **Present status of corticotropin (ACTH), cortisone, and hydrocortisone in ophthalmology.** Brit. J. Ophth. **37**:85-98, Feb., 1953.

The maximum value of corticotropin and cortisone is dependent upon their early use. They are two different hormones, with two different modes of action. Because cortisone can be used topically it is chosen in the average case of superficial ocular disease. Deeper involvement may demand systemic therapy with either corticotropin or cortisone. Corticotropin used as an intravenous drip for eight or more hours has proved to be the most effective systemic therapy. Combinations of local or oral cortisone and systemic corticotropin (especially in a long-acting vehicle) can be used in chronic disease. If the acute process does not respond rapidly one must consider either increasing the dose or changing to the alternative hormone. Evidence of bacterial infection is an indication for the supplementary use of antibiotics. Other measures, such as atropine and artificially induced fever, still have their place in treatment. Relapse after the cessation of hormonal therapy is not a contraindication to its use. (4 tables, 27 references)

Orwyn H. Ellis.

Hansell, P., and Beeson, E. J. G. **Retinal photography in colour.** Brit. J. Ophth. **37**:65-69, Feb., 1953.

The present work is concerned with the development of a new light source to be used with a Zeiss-Nordenson camera for

color photography of the retina. The illumination should be sufficiently constant to allow alignment and focusing of the optical system and visual examination of the retina without discomfort to the patient. It should be stable, constant, and of a spectral emission suited to color-film sensitivity. The illumination should be greatly increased for the actual moment of photographic exposure. To minimize discomfort and involuntary movement and blinking on the part of the patient, 1/25 second should be the maximum permissible exposure. The lamp is run as a continuous arc for focusing, then over-run or pulsed at a high current for an instant during its normal running as a 150w continuous arc. This requires it to be pulsed at some 5,000w to achieve results on color film at an exposure of 1/25 second. A control unit for this pulse operation was developed. The lamp may be mounted vertically on the Zeiss-Nordenson camera in the position normally occupied by the carbon-arc housing. The electrodes can be positioned in relation to the first condenser, and thereafter the vertical and horizontal slides provided on the instrument can be used for centering the arc. The FA5 lamp has characteristics which make it suitable for this and other uses. Where constant adjustment and focusing of an optical system are required, the steady source of light together with the ability to produce a flash at a desired moment meet many needs in slitlamp photography, and photomicrography and time-lapse photography of living matter. (6 figures, 3 references) Orwyn H. Ellis.

Kitlowski, Edward A. **The treatment of keloids and keloidal scars.** Plast. & Reconstruct. Surg. **12**:383-391, Dec., 1953.

The author distinguishes between a keloid and a keloidal or hypertrophic scar, pointing out that the former is a fibroma usually of the fibrous tissue of the corium, and the keloidal scar is contracted fibrous tissue which can be aggravated by the resulting contracture of the surrounding skin which causes it to thicken and simulate a keloid. Keloid scar formation may be minimized by removal of excess granulations from the surface to be grafted. The author believes that a keloid should not be removed completely and that care should be taken not to traumatize normal skin. Massage over a period of months will cause a keloidal scar to soften, whereas a keloid will not soften under massage. The correction of the keloidal scar can be accomplished by complete or gradual excision, shifting of neighboring tissue to relieve the tension, grafting with skin or flaps, depending on the situation.

Alston Callahan.

Lavery, F. S. **Value of cortisone and ACTH in ocular diseases.** Tr. Ophth. Soc. U. Kingdom **72**:193-201, 1952.

The author reports the experience of a group of ophthalmologists in Dublin who carried out clinical research into the effects of cortisone in ophthalmic conditions. The results obtained were in the main in agreement with other workers. The most important ophthalmic condition controlled by cortisone was sympathetic ophthalmia. Two patients are described. Cortisone was used locally in ophthalmic conditions by subconjunctival injection, in ointment form and as eye drops. Iridocyclitis and interstitial keratitis responded with equal rapidity to both methods of administration. The therapeutic effect of Filatov's tissue therapy with biogenic stimulants is directly opposite to that of cortisone: it stimulates repair, while cortisone suppresses or delays the formation of fibrous tissue. Beulah Cushman.

Lepri, G. **ACTH and cortisone in the treatment of Sjøgren's syndrome.** Ann. d'ocul. **186**:351-356, April, 1953.

Seven typical cases of Sjøgren's syndrome were treated either by cortisone

administered locally, or by a combination of cortisone locally with ACTH, or cortisone given systemically. In almost all cases, there was an immediate beneficial effect subjectively, but the symptoms recurred shortly after stopping treatment. (10 references) John C. Locke.

Lepri, G., and Fornaro, L. **Cortisone in ocular tuberculosis.** Giorn. ital. oftal. **4**: 359-384, July-Aug., 1953.

The authors have attempted to ascertain the effect of cortisone on 1. the course of experimental ocular tuberculosis in normal rabbits, 2. the course of experimental ocular tuberculosis in previously sensitized rabbits, and 3. on the skin and ocular sensitivity to tuberculin in rabbits infected respectively by intramuscular injection and by inoculation into the anterior chamber. In each case controls were used. In the first series there was a greater dissemination of nodules, but a quieter, less congested course of the disease, in the second a marked inhibition and reduction of inflammatory manifestations in those cases treated with cortisone, and in the third there was marked inhibition of dermal and ocular sensitivity.

Cortisone was given in the form of hypodermic injection (5 mg. daily), subconjunctival injections (10 mg. every three days), and application of an ointment (1-percent, twice daily). Cortisone should play a part in the treatment of allergic ocular manifestations due to tuberculosis, while it should be withheld in those tuberculous conditions with a tendency to localization of the bacilli in the eye.

V. Tabone.

Levitt, H. **The slot hand perimeter.** A.M.A. Arch. Ophth. **50**:352-353, Sept., 1953.

The standard hand perimeter is modified by making a slot along its circumference to facilitate localization of retinal tears. (1 figure) G. S. Tyner.

Lloyd, J. P. F. **Terramycin.** Tr. Ophth. Soc. U. Kingdom **72**:573-583, 1952.

The author used 5 mgm. of terramycin per gm. in a base of paraffin molle flav. in 25 patients. The ointment was being inserted into the conjunctival sac once every four hours. Fifteen patients responded well and apparently were cured; there was apparent failure without adverse reactions in five and two were not helped and symptoms of irritation appeared. Three other patients were helped but had other treatment at the same time. Patients with acute chronic and recurrent conjunctivitis were included as well as four patients with blepharitis squamosa.

Beulah Cushman.

Long, J. C., Black, W. C., and Danielson, R. W. **Aspiration biopsy in intraocular tumors.** A.M.A. Arch Ophth. **50**: 303-310, Sept., 1953.

The authors describe a method for aspiration biopsy of intraocular tumors. In nine of 11 cases of intraocular tumor a positive diagnosis was made. The procedure affords a safe method of differential diagnosis in suspected ocular malignancy before enucleation. (3 figures)

G. S. Tyner.

Mackie, E. G. **Value of cortisone and ACTH in ocular diseases.** Tr. Ophth. Soc. U. Kingdom **72**:201-232, 1952.

To use cortisone and ACTH intelligently it is essential to review adrenocortical physiology. Cortisone, through its effect in suppressing general cell energy, mitosis and migration, may act so as to diminish the phagocytosis and clearance of pigment debris by the wandering endothelial phagocytic cells and it may equally well discourage the proliferation of the pigmented epithelium of the ciliary body.

In the discussion the value of the intravenous use of ACTH and of the local use of cortisone in the eye in the treatment

of sarcoidosis was emphasized.

Beulah Cushman.

Maroger, Marc. **General anesthesia in ophthalmology.** Ann. d'ocul. **186**:523-537, June, 1953.

The author reviews the various anesthetic agents, and the methods of administration and premedication in the light of the peculiarities pertaining to anesthesia in ophthalmic surgery. The anesthesia is almost always for children. It is most often given for strabismus, and while psychic disturbances can result from this affection, it is on the borderline of cosmetic surgery, and therefore the anesthetic risk ought to be minimal. The anesthetist does not have control of the respiratory passages unless he resorts to intratracheal intubation. The ophthalmologist should cooperate with the anesthetist by being patient, by warning him if the blood has a darker colour, and by handling tissues gently. John C. Locke.

McGannon, William J. **Teletrainer.** A.M.A. Arch. Ophth. **50**:354-355, Sept., 1953.

By means of a pair of polaroid glasses and two polaroid lenses in front of a television screen, one set at 180 and the other at 90 degrees, a patient may receive orthoptic training. (1 figure) G. S. Tyner.

Németh, L. **Indications for serial retrobulbar administration of anesthetics and the results to be expected.** Szemészet **4**: 154-159, 1953.

Retrobulbar anesthesia is produced with 1 cc. of 1 per mille pantocain. The injections are given initially every day, later every other day, until 10 injections have been given. The procedure is to be tried in chronic glaucoma if other methods have failed, further in the total or partial occlusion of the central artery if spastic phenomena are present, and in partial thrombosis of the central vein with hypertonia or arteriosclerosis. Otherwise incurable cases of macular degeneration and pigment degeneration of the retina may occasionally respond favourably to this treatment. Discomfort due to an irritated, painful, slightly shrunken globe, the enucleation of which was refused by the patient, ceased after this therapy.

Gyula Lugossy.

Pettinati, S. **Radiologic localization of ocular foreign bodies.** Rassegna ital. d'ottal. **22**:423-436, July-Aug., 1953.

The various methods of localizing intra- and extra-ocular foreign bodies are discussed and compared. The author finds that the use of the Goldman and Bangerter ring combined with the schema of Dufour affords the best results. Several different cases are recorded to illustrate the value of the method. (3 figures, 21 references) Eugene M. Blake.

Rambo, V. C. **Simple suggestion for better ophthalmic instrument trays and tables.** A.M.A. Arch. Ophth. **50**:510-511, Oct., 1953.

Rectangular sticks of wood are placed on the instrument tray and covered with a sterile cloth. This protects the points of the instruments by elevating the instrument from the tray. (1 figure)

G. S. Tyner.

Ridley, Harold. **Recent methods of fundus examinations including electronic ophthalmology.** Tr. Opth. Soc. U. Kingdom **72**:497-501, 1952.

The author reviews the structure and use of ophthalmoscopes from the indirect type of Helmholtz of 1851 to the direct, as well as modern work, to develop an electronic ophthalmoscope with the use of a cathode ray tube. It is hoped that more light can be made available with it so that the image of the retina can be projected and observed on viewing screens.

Beulah Cushman.

Schaefer, R. **Work physiology of an ophthalmologic practice.** Klin. Monatsbl. f. Augenh. **123**:454-462, 1953.

The author has measured the time it takes to take a patient from one instrument to another during a thorough eye examination. It takes up nearly one third of the entire examination time. A swivel table has therefore been devised which contains the most important instruments. All of them can be used without having the patient change his seat or his position. (1 figure) Frederick C. Blodi.

Tower, Paul. **A simple method for sterilizing the tonometer.** A.M.A. Arch. Ophth. **50**:512-513, Oct., 1953.

A sterilizer for the tonometer is described which utilizes boiling distilled water. (1 figure, 3 references)
G. S. Tyner.

Wayne, E. J. **Recent advances in ocular therapeutics.** Tr. Ophth. Soc. U. Kingdom **72**:549-556, 1952.

Individuals at one end of the scale can properly be said to be tolerant of a drug and those at the other to be hypersensitive. This is to be distinguished from idiosyncracy, a wholly abnormal reaction. Patients showing a hypersensitivity do not have a true idiosyncrasy. In idiosyncrasy the body proteins form an abnormal compound which is capable of initiating antibody formation and thereby eliciting an antigen-antibody reaction. This occurs after the individual has had previous contact with the drug. Antihistamines are relatively ineffective in the cellular reaction of the reaction, but cortisone is effective. Staphylococci resistant to penicillin are usually sensitive to chloramphenicol and aureomycin. The author feels that causative organisms should be isolated and their sensitivity assessed. When vitamin deficiencies do occur the response to treatment is usually dramatic. Allergy to sex hormones was the basis for treatment in patients with acne rosacea but the author found the reaction to testosterone to be questionable. As critical an approach to therapeutics as possible should enable one to discard ineffective drugs quickly.
Beulah Cushman.

Zubczewski, Adam. **Practical application of Grzedzielski's method in localization of intraocular foreign bodies.** Klinika Oczna **23**:121-132, 1953.

The author describes a modification of Grzedzielski's method of localization of intraocular foreign bodies, and presents one case for illustration, going through all the steps of Grzedzielski's method. (17 figures, 6 references) Sylvan Brandon.

6

OCULAR MOTILITY

Cashell, G. T. Willoughby. **Long term results of treatment of concomitant convergent strabismus in terms of binocular function.** Tr. Ophth. Soc. U. Kingdom **72**: 367-381, 1952.

The author reports on the treatment of concomitant convergent strabismus as reported by various ophthalmic and orthoptic departments from all parts of the United Kingdom during the year 1949. He includes those patients in whom all regular treatment had been discontinued either because the results were satisfactory or the achievement of binocular vision was thought to be impossible but the cosmetic results satisfactory. Eighteen hospitals participated. In the review 1,119 patients were included; 33 percent were discharged with binocular vision. Better results were obtained in patients whose squint was gradual in onset, and in those who were treated early. Treatment included glasses, occlusion, orthoptic treatment and operation. The average number of orthoptic treatments varied and was combined with surgery in 38.8 to 49.8 percent of patients. Operative treatment was

carried out between the ages of five to ten years on 820 patients. Binocular vision was obtained in 50 percent.

Beulah Cushman.

Cogan, D. G., and Adams, R. D. **A type of paralysis of conjugate gaze (ocular motor apraxia).** A.M.A. Arch. Ophth. **50**: 434-442, Oct., 1953.

The authors differentiate ocular motor apraxia from true paralysis of conjugate gaze. Two cases demonstrating apraxia are reported and similar reported cases are reviewed. In cases of oculomotor apraxia the patient has impairment of willed movements of the eyes but retains random movement. In true conjugate gaze paralysis there is loss of both willed and random movement. (1 figure, 14 references) G. S. Tyner.

Douglas, A. A. **Treatment of concomitant convergent strabismus.** Tr. Ophth. Soc. U. Kingdom **72**:383-394, 1952.

The author reviews 100 patients from the Birmingham and Mildand Eye Hospital treated and discharged between 1935 and 1943. The results should be judged by the cover test. Of 36 patients discharged as cured, 14 were found to have a manifest deviation both without and with glasses. Of the 14, six probably had never been cured, and the remaining eight must be presumed to have relapsed. Twenty-two patients remained straight; in 13 of them binocular vision was fair, most of them had poor convergence and some had excessive heterophoria. In seven binocular function was poor and none appreciated stereopsis.

Sixty-four patients were cosmetically satisfactory on discharge, 13 had binocular single vision and 13 acquired it during the years since discharge. Of these, eleven had been convergent and two slightly divergent.

Two series are compared in respect to the average amount of time devoted to orthoptic training of each series. The results in those who had had no training were almost identical as in those who had had training. Ophthalmic surgeons must inquire whether orthoptic treatment should continue, although public opinion at present may appear to demand exercises. Douglas advises that functioning of the hard working orthoptists, and their training too, should be radically redirected. Beulah Cushman.

Foster, John. **Case notes: variant of the Lancaster diplopia test.** Brit. J. Ophth. **37**:378-380, June, 1953.

A variant of the Lancaster diplopia test is described. The area of diplopia is first outlined. Then, with goggles in place, representation of primary and secondary deviation with the field of diplopia are recorded. The applications of this test in cases of phoria, paresis, abnormal retinal correspondence and central nervous system lesions are presented. (7 figures, 6 references) Orwyn H. Ellis.

Franceschetti, A., Monnies, M., and Dieterle, P. **Electronystagmography in the analysis of congenital nystagmus.** Tr. Ophth. Soc. U. Kingdom **72**:515-532, 1952.

The electro-nystagmogram measures the potential derived from the electropositive cornea and the posterior electronegative surface of the ocular globe. Each ocular movement provokes a displacement of the electrical field which can be registered on an apparatus such as the electro-encephalograph. The sign of the deflection gives the direction of the movement of the eye and the amplitude of deflection.

The authors recorded the form and frequency of nystagmic movements of the pure horizontal type of nystagmus. Their aim was to show the relation between frequency and amplitude of nystagmus with respect to the position of gaze and to determine the minimum. The simultaneous recording of the movements of each eye

could be studied even when one eye was closed, thus eliminating the factor of binocular fixation. The relation of torticollis and congenital nystagmus was brought out in that the direction of gaze is that position in which nystagmus reaches a minimum and corresponds to the fixing eye.

The frequency of the nystagmus plays an essential role in the determination of the compensatory position of gaze. The patient prefers to look where the frequency is low. The frequency and amplitude of the nystagmus changes with the fixing eye and its position. The nystagmus of the closed eye takes on the character of that of the fixing eye, especially as to frequency and direction of the rapid phase. The ENG confirms the known fact that there exists a position for the eyes, where the frequency and amplitude reach a minimum. This position corresponds to an optimum for vision and determines the compensatory torticollis. The position of the eye where the nystagmic jerks arrive at a minimum can change from one eye to the other or correspond to the same direction of gaze. This systematic examination has brought to light a new etiology for squint in congenital nystagmus in that the image in one eye is suppressed when the direction of the nystagmus varies from one eye to the other. (17 figures)

Beulah Cushman.

Houlton, A. C. L. **Treatment of concomitant convergent strabismus.** Tr. Ophth. Soc. U. Kingdom 72:377-401, 1952.

The author surveyed the records of 104 alternating squint patients: 77 were discharged without binocular vision and 27 with binocular vision. Twenty-two had pre-operative orthoptic treatment, and 18 had some orthoptic treatment after surgery. The survey seems to show that orthoptics makes very little difference to the child with an alternating squint.

Beulah Cushman.

Jonkers, G. H. **The treatment of squint.** Geneesk. gids., Feb., 1953.

The author is convinced that to prevent or to cure amblyopia or abnormal correspondence, the treatment of squint must start as early as possible. On the ground of theoretical and practical considerations he does not see the value of operations at an age when orthoptic training cannot be done.

G. H. Jonkers.

Lyle, T. Keith. **Treatment of concomitant convergent strabismus.** Tr. Ophth. Soc. U. Kingdom 72:403-416, 1952.

The author reviewed a series of 172 private patients treated from 1947 to 1950. Normal binocular function was restored in 76 patients (44 percent). 28 did not require operation, 12 required refraction, and 12 orthoptic treatments in addition, and four had occlusion as well. The 28 who required no surgery had strabismus of the accommodative type; in these the average age of onset was three and one-half years. Surgery was required by 144 patients; of these 48 achieved binocular vision. Of the 172 patients, 93 had satisfactory results from the cosmetic point of view, although in 58 of them the visual axes were not parallel. Preoperative orthoptic treatment is not usually necessary and the author doubts whether the time spent upon it is justifiable.

Beulah Cushman.

Örgen, Cahid. **Case notes: chronic progressive external ophthalmoplegia.** Brit. J. Ophth. 37:365-368, June, 1953.

This rare disease with familial and hereditary tendencies, begins in childhood. Ptosis and total external ophthalmoplegia are found. A patient is described who was made comfortable by hypocorrection of the ptosis. This was achieved by the insertion of bands of fascia lata between the margin of the lid and the frontalis muscle. (7 figures, 17 references)

Orwyn H. Ellis.

Parsons-Smith, Gerald. **Activity of the cerebral cortex in amblyopia.** Brit. J. Ophth. **37**:359-364, June, 1953.

Fifty cases of amblyopia exanopsia were investigated. Only 24 percent of the patients had normal electroencephalograms in childhood, and 62 percent had grossly abnormal records. No relationship was found between the degree of visual loss and the incidence of the abnormalities in the E.E.G. Clinical features of congenital and acquired amblyopia showed a marked correspondence, but differed in response to occlusion. During the year following the completion of the orthoptic treatment no significant alteration in the E.E.G. occurred either in those patients who had responded to the occlusion or in those who had failed to do so. When a normal E.E.G. is associated with a severe degree of amblyopia the prognosis for recovery of vision is poor. The E.E.G. is abnormal in certain ophthalmic conditions in childhood which have been considered to result from developmental defects. Once the appearances of cortical immaturity have been replaced by stable adult rhythms, any associated physical defect is unlikely to be corrected. The abnormalities of the E.E.G. fall into two classes. First, non-specific cortical dysrhythmias, of which bursts of fast activity or occipital slow waves are the commonest, and second, larval bursts of epileptic discharges. The disturbance of the cortical rhythms supports the thesis that abnormalities are present in the central nervous system in amblyopia associated with strabismus. (4 references)

Orwyn H. Ellis.

Sokolic, Petar. **Shortening of a muscle by torsion and tucking.** Klin. Monatsbl. f. Augenh. **123**:474-476, 1953.

A suture is put across the belly of the muscle. With a muscle hook the peripheral part of the muscle is lifted and twisted. The preplaced suture is then tied around the neck of the muscle fold. The hook is rotated back into its original position and withdrawn. In that way a fold of the muscle is produced, the length of which can be varied according to the degree of deviation. (3 figures)

Frederick C. Blodi.

Stansworth, A. **Paramacular and peripheral fusion.** Tr. Ophth. Soc. U. Kingdom **72**:613-622, 1952.

The author emphasizes the possibility of peripheral fusion as a valuable factor in maintaining straight eyes. He quotes Burian and Winkleman who used targets which included the foveal and perifoveal regions. He plotted the central scotoma by Traver's method. Peripheral and paramacular fusion requires more investigation as some patients might become straight after paramacular fusion training.

Beulah Cushman.

Waardenburg, P. J. **Retraction syndrome and concomitant phenomena.** Arch. f. Ophth. **154**:96-109, 1953.

The author first enumerates a number of conditions which were found combined with retraction of the globe, such as keratoconus, microcornea, persistent pupillary membrane, heterochromia iridis, congenital cataract, coloboma of the fundus, optic atrophy, high hyperopia and nystagmus. He also mentions paresis of the facial nerve, ptosis, asymmetry of the face and malformations of the ears and teeth. Other anomalies are cervical ribs, cervical spina bifida, torticollis and the occurrence of syringomyelia. After having mentioned these defects in combination with retraction of the globe, the author describes in detail three cases combined with Klippel-Feil synostosis. The ocular motility was found disturbed as would be expected from the involvement of the abducens nerve and muscle. Pathogenetically the author considers congenital and hereditary factors. He feels that retraction

might represent one of the signs by which the status dysraphicus is characterized. A developmental disturbance of the muscles or of the cerebral nerve-nuclei or of both might be the most important pathogenetic factor. (11 figures, 50 references)

Ernst Schmerl.

7

CONJUNCTIVA, CORNEA, SCLERA

Ainslie, D. **Treatment of corneal infection with Ps. pyocyanea by subconjunctival injection of polymyxin E.** Brit. J. Ophth. **37**:336-342, June, 1953.

The subconjunctival injection of Polymyxin E in a series of cases of corneal infection with Ps. pyocyanea is reported. When treatment was started, every case appeared to be progressing rapidly towards loss of the eye but the infection was overcome by subconjunctival injections. Twice the infection recurred after cessation of the first course of treatment, but was rapidly brought under control again by a second course. Treatment should always be continued for several days after the clinical appearance indicates that the infection has been overcome. There was a tendency for the still necrotic cornea to be invaded by secondary infective organisms, particularly staphylococci. A suitable antiseptic ointment should be applied frequently. Streptomycin given subconjunctivally was followed by temporary improvement. Immediate improvement followed the polymyxin injections in all cases. (6 references)

Orwyn H. Ellis.

von Berger, G. P. **A case of primary tuberculosis of the conjunctiva.** Giorn. ital. oftal. **4**:385-394, July-Aug., 1953.

After a review of the literature on and the forms of tuberculous conjunctivitis, the author describes in detail a case of primary tuberculosis of the conjunctiva, exhibiting both nodular and ulcerative features. The tubercle bacillus was recovered from the margin of the ulcer, and histologic examination of the tissues at the margin of the ulcer showed the usual tuberculous change. Treatment was by means of streptomycin and PAS, and clinical cure was achieved within 30 days.

V. Tabone.

Busse Grawitz, P. **Inflammation of the cornea without blood-leucocytes.** Arch. f. Ophth. **154**:1-7, 1953.

Rabbits were used to produce a keratitis with the help of ultraviolet light. When a minimal stimulus was applied nothing but so-called precursor cells of leucocytes could histologically be demonstrated. From these findings the author reaches the conclusion that his experiments demonstrate the local origin of leucocyte-like cells. (2 figures, 8 references)

Ernst Schmerl.

Faldi, S. **Bilateral follicular hyperplasia of the conjunctiva—a histo-pathologic study.** Rassegna ital. d'ottal. **22**:361-379, July-Aug., 1953.

The author describes in minute detail the picture of the nodular type of overgrowth of lymphoid tissue in the conjunctiva of an obese 14-year-old girl. As a result of clinical, biomicroscopic, and histologic study, the diagnosis of bilateral hyperplastic lymphomatosis was made. Local treatment with cortisone and antibiotics was unsuccessful and neuroendocrine disturbances were held responsible. The whole question of the various lymphoid diseases of the conjunctiva is fully considered. (4 figures, 60 references)

Eugene M. Blake.

Flocks, Milton. **Tuberculous lymphadenitis, allergic vasculitis and phlyctenulosis.** California & West. Med. **79**:319-322, Oct., 1953.

Lymphadenitis, tender nodules in the

skin of the legs and the ulnar borders of both arms, and three limbal phlyctenules with others on parts of the bulbar conjunctiva were noted in a young male native of Guam, aged 18 years. Corneal scars from previous phyctenules were also present. Biopsies were made of the skin nodules, lymph nodes, and phylctenules. The skin nodules showed a periarteritis nodosa, the glands contained tubercules with the bacilli. Guinea pig tests for tuberculosis were positive. The ultimate diagnosis, suggested by the ocular lesions, was changed to tuberculous lymphadenitis and erythema nodosum simulating polyarteritis nodosa. The use of cortisone and ACTH in these diseases makes it important to rule out tuberculosis. (3 figures, 8 references) Francis M. Crage.

Fontana, G. **Vascular abnormalities at the limbus in cases of psoriasis.** Giorn. ital. oftal. **4**:316-321, July-Aug., 1953.

Out of 30 patients with psoriasis, six showed lesions of the anterior segment of the eye; five of these had engorgement of the vessels at the limbus which exhibited also irregular dilatations, while the other showed opacities in the anterior part of the lens, more marked at the periphery. The possible connection between the ocular and skin manifestations is suggested and the hypothesis of an endogenous allergic basis for the phenomena is advanced. V. Tabone.

Fraser, H. **Case notes: subconjunctival injection of polymyxin. B.** Brit. J. Ophth. **37**:369, June, 1953.

It was shown that the course of a severe hypopyon corneal ulcer was very favorably affected by subconjunctival injection of polymyxin B. (1 reference)

Orwyn H. Ellis.

Gualdi, G. **Autoplasm in the treatment of corneal wounds.** Rassegna ital. d'ottal. **22**:393-400, July-Aug., 1953.

By the use of autoplasm and calcium chloride it was demonstrated that corneal wounds in rabbit eyes healed without complications and with less local reaction than when sutured. This is ascribed to the firm adhesive quality of the coagulated fibrin at the margins of the wound. (14 references) Eugene M. Blake.

Karsch, Johannes. **Chemical keratoconjunctivitis in a synthetic silk plant in Pirna.** Klin. Monatsbl. f. Augenh. **123**: 440-449, 1953.

This plant lies in East Germany. Because of its location in a narrow valley and because of poor ventilation the incidence of keratoconjunctivitis due to hydrogen sulphide increased sharply. Almost a thousand cases could be observed during the 13 months from November, 1950, to November, 1951. The conjunctiva shows a severe irritation and the cornea may be affected in the interpalpebral zone. (3 figures, 7 references)

Frederick C. Blodi.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received at least three months before the date of occurrence.

Deaths

Dr. Edward Henry Cary, Dallas, Texas, died December 11, 1953, aged 81 years.

Dr. George H. Kress, former senior ophthalmic surgeon at the Los Angeles County Hospital and former editor of *California and Western Medicine*, died in Los Angeles on January 18, 1954, of a coronary attack at the age of 81 years.

Announcements

Washington University course

The Department of Ophthalmology of the Washington University School of Medicine announces its 34th annual course in the basic sciences of ophthalmology. The next session begins October 4, 1954, and ends June 4, 1955. The number of students is limited.

Instruction includes approximately 400 hours of didactic work and 750 hours of clinical work. The course is designed to provide the student with an adequate background for a residency or a preceptorship in ophthalmology.

All inquiries or applications should be addressed to: Department of Ophthalmology, Washington University School of Medicine, 640 South Kingshighway Boulevard, Saint Louis 10, Missouri.

International symposium at Iowa

"Problems in physiology and pathology of the eye" will be the subject of discussion at an International Symposium to be sponsored by the Department of Ophthalmology, College of Medicine, State University of Iowa, Iowa City, Iowa, on Friday, September 24, and Saturday, September 25, 1954. The program follows:

Friday, September 24, 1954

8:30 a.m.—Gunnar von Bahr (Uppsala, Sweden), "Corneal thickness: Its measurement and changes." Discussion opened by Peter C. Kronfeld, Chicago, Illinois.
10:00 a.m.—Recess
10:30 a.m.—Giambattista Bietti (Parma, Italy), "Ophthalmic problems in diabetes and hypoglycemia." Discussion opened by George W. Bounds, Jr., Iowa City, Iowa.
12:00 noon—Lunch
1:30 p.m.—Hans Goldman (Berne, Switzerland), "Slitlamp microscopy of the fundus." Discussion opened by Alson E. Braley, Iowa City, Iowa.
3:00 p.m.—Recess
3:30 p.m.—Eugene Wolff (London, England), "Ophthalmic pathology of fat." Discussion opened by Alfred E. Maumenee, San Francisco, California.

Saturday, September 25, 1954

8:30 a.m.—G. B. J. Keiner (Zwolle, Netherlands), "Optomotor reflexes." Discussion opened by Francis Heed Adler, Philadelphia, Pennsylvania.
10:00 a.m.—Recess
10:30 a.m.—H. K. Müller (Bonn, Germany), "Phosphate metabolism of the lens." Discussion opened by P. J. Leinfelder, Iowa City, Iowa.
12:00 noon—Lunch
1:30 p.m.—J. Boeck (Graz, Austria), "Periarteritis nodosa and related diseases." Discussion opened by Frederick C. Blodi, Iowa City, Iowa.
3:00 p.m.—Recess
3:30 p.m.—Harold Henkes (Rotterdam, Netherlands), "Electroretinography." Discussion opened by Hermann M. Burian, Iowa City, Iowa.

Basic course in orthoptics

The basic course in orthoptics for technicians, sponsored by the American Orthoptic Council, will be held in the Department of Ophthalmology, University Hospitals, Iowa City, Iowa, from June 17 through July 3, 1954. As usual, there will be didactic lectures and practical demonstrations under the direction of an outstanding faculty.

Eye surgery refresher course

The University of Toronto, Faculty of Medicine, announces an Eye Surgery Refresher Course to be given April 26 to April 30, 1954. Mr. John Foster, Leeds, England, and Dr. Wendell Hughes, Hempstead, New York, will be the guest surgeons. The course will be given for a minimum of 10 and a maximum of 30 students. The fee will be $100.00, payable to the chief accountant, Simcoe Hall, University of Toronto. Applications should be made to the Dean of the Faculty of Medicine. The program follows:

Monday, April 26

Toronto General Hospital

a.m.
9:00-9:15 Registration and Welcome by *Dean MacFarlane*
9:15-10:30 "Practical Points of Intracapsular Cataract Extraction"—*Mr. J. Foster*

10:30-10:45 Discussion
11:00-12:00 "Lower Lid Reconstruction" (with colored film)—*Dr. W. L. Hughes*

p.m.
2:00-2:45 "Cataract Extraction through Clear Cornea"—*Dr. C. McCulloch*
2:45-3:00 Discussion
3:15-4:30 Clinico-pathological Conference on Glaucoma
Chairman—*Dr. T. H. Hodgson*
Panel—*Dr. O. B. Richardson, Dr. A. E. MacDonald, Dr. F. J. A. Johnston*
8:30-10:30 Academy of Medicine, Section of Ophthalmology
"General Ophthalmic Surgery Experience"—*Dr. W. L. Hughes*
"Dacryocystorhinostomy"—*Mr. J. Foster*

Tuesday, April 27

GROUP I— ST. MICHAEL'S HOSPITAL

a.m.
9:00-12:00 Dacryocystectomy—*Dr. R. G. C. Kelly*
Intraocular Operations—*Mr. J. Foster*

GROUP II—TORONTO GENERAL HOSPITAL

a.m.
9:00-12:00—Glaucoma operation—*Dr. T. H. Hodgson*
Detachment operation—*Dr. H. M. Macrae*

GROUPS I AND II—HOSPITAL FOR SICK CHILDREN

p.m.
2:00-3:30 Symposium on Strabismus
Chairman: *Dr. A. L. Morgan*
Diagnosis: *Dr. W. P. Callahan*—Operative Technique: *Dr. J. S. Crawford*
Causes of Failure: *Dr. A. L. Morgan*
Discussion: *Dr. W. L. Hughes, Mr. J. Foster*
3:45-4:30 "Principles of Ptosis Surgery"—*Dr. W. W. Wright*
Discussion: *Dr. R. G. C. Kelly, Dr. J. S. Crawford*

Wednesday, April 28

GROUP I—SUNNYBROOK HOSPITAL

a.m.
9:00-12:00 Cataract operation—*Dr. W. L. Hughes*

GROUP II—TORONTO WESTERN HOSPITAL

a.m.
9:00-12:00 Cataract operation—*Mr. J. Foster*
Intraocular operation—*Dr. C. McCulloch*

GROUPS I AND II—TORONTO GENERAL HOSPITAL

p.m.
2:00-2:45 "Surgery of Ectropion"—*Dr. W. L. Hughes*
2:45-3:00 Discussion—*Dr. J. C. Hill*
3:15-4:15 "Surgery of Orbital Tumours"—*Mr. J. Foster* (with coloured film).

GROUP I—
4:30-5:30 Cadaver Surgery—*Dr. W. L. Hughes*
7:00 Complimentary Dinner for Course
"Curiosities of Ophthalmology"—*Mr. J. Foster*

Thursday, April 29

GROUP I—TORONTO GENERAL HOSPITAL

a.m.
9:00-12:00 Glaucoma operation—*Dr. T. H. Hodgson*
Detachment operation—*Dr. H. M. Macrae*

GROUP II—SUNNYBROOK HOSPITAL

a.m.
9:00-12:00 Intraocular operations—*Dr. W. L. Hughes*

GROUPS I AND II—TORONTO GENERAL HOSPITAL

p.m.
2:00-2:45 "Surgical Treatment of Diplopia Following Orbital Fracture"—*Mr. J. Foster*
2:45-3:00 Discussion
3:15-4:15 "Surgery for Cataract with Glaucoma"—*W. L. Hughes* (with film)
4:15-4:30 Discussion

GROUP II—
4:30-5:30 Cadaver Surgery—*Dr. W. L. Hughes*

Friday, April 30

GROUPS I AND II—TORONTO GENERAL HOSPITAL

a.m.
9:00-9:30 "Pre-operative Preparation for Intraocular Surgery"—*Dr. H. L. Ormsby*
9:30-10:00 "Minor Surgical Procedures"—*Dr. R. G.C. Kelly*
10:15-11:15 "Recent Advances in Treatment of Retinal Detachment"—*Dr. H. M. Macrae* (with coloured film)
11:15-11:30 Discussion

GROUPS I AND II—ST. MICHAEL'S HOSPITAL

p.m.
2:00-2:30 "Intraocular foreign body surgery"—*Dr. W. R. F. Luke*
2:30-3:15 "Surgery of Entropion"—*Dr. W. L. Hughes*
3:30-4:15 "Keratoplastic Technique"—*Mr. J. Foster*

PAN-PACIFIC SURGICAL ASSOCIATION

The Sixth Congress of the Pan-Pacific Surgical Association will be held in Honolulu, October 7 to 18, 1954. Those doctors planning to attend are urged to make arrangements as soon as possible.

An outstanding scientific program with over 100 leading surgeons, including sessions in all divisions of surgery and related fields, promises to be of interest to all members of the profession. An extensive social program is being developed for the doctors' families.

The association office has been appointed as travel agent for those attending the congress and it is important that all hotel and travel reservations be made through the Honolulu headquarters of the Pan-Pacific Surgical Association.

For further information, please write to F. J. Pinkerton, M.D., Director General, Pan-Pacific

Surgical Association, Suite Seven, Young Building, Honolulu, Hawaii.

Orthoptic examinations

The annual examination of orthoptic technicians by the American Orthoptic Council will be conducted in July and September, 1954.

The written examination will be nonassembled and will take place on Thursday, July 22nd, in certain assigned cities and offices, and will be proctored by designated ophthalmologists.

The oral and practical examinations will be on Saturday, September 18th in New York City, just preceding the meeting of the American Academy of Ophthalmology and Otolaryngology.

Applications for examination will be received by the office of the secretary of the American Orthoptic Council, Dr. Frank D. Costenbader, 1605 22nd Street, N.W., Washington 8, D.C., and must be accompanied by the examination fee of $30.00. Applications will not be accepted after June 1, 1954.

American Goiter Association

The 1954 meeting of the American Goiter Association will be held at the Somerset Hotel, Boston, Massachusetts, April 29, 30, and May 1, 1954. The program for the three-day meeting will consist of papers and discussions dealing with the physiology and diseases of the thyroid gland.

Research fellowship available

Information regarding a research fellowship in Ophthalmology at Indiana University Medical Center may be obtained by writing to Dr. T. F. Schlaegel, Jr., 1100 West Michigan Street, Indianapolis 7, Indiana. It is not necessary to have had training in ophthalomology to be accepted for this position. For those who have not had a graduate course in ophthalmology, the fellowship will provide some training prior to a residency. Fellows assist in the eye clinic and at eye surgery and attend the formal classes for eye residents. The stipend is $1,800.00 per year, plus room and laundry.

Tuition fee reduced

The tuition fee for the nine months' course in basic ophthalmology offered by the Department of Ophthalmology, Wayne University College of Medicine, Detroit, has been reduced from $900.00 to $500.00. For further information concerning this course, which begins September 13, 1954, write to: Dr. A. D. Ruedemann, chairman, Department of Ophthalmology, 690 Mullett Street, Detroit 26, Michigan.

Eye-Bank transportation

The Eye-Bank for Sight Restoration, Inc., of North Carolina, chartered by the state in 1951 to obtain and supply eyes to North Carolina hospitals and physicians, is affiliated with the Eye-Bank for Sight Restoration, Inc., New York. Eyes are carried without charge by the Piedmont Airlines, Eastern Airlines, Capital Airlines, and by private taxi and limousine services.

Cancer section

Excerpta Medica, now in its seventh year of publication, has recently launched the monthly publication of a cancer section (Section XVI). This project is being assisted by grants from the American Cancer Society and the National Cancer Institute.

League against Trachoma prize

Competition for the Chibret Gold Medal 1955 (value 200,000 French francs) is open to trachomatologists of all nations. The subject to be submitted may be in any one of the following categories: clinical, social, prophylaxis, medical, or surgical therapy. The report must be written in French, three copies must be submitted, and it must be accompanied by a one-page summary in French and, if possible, in English, Italian, Spanish, Portuguese, and German. The report must be sent before January 1, 1955, to the Secretary General, Dr. Jean Sédan, 94 Rue Sylvabelle, Marseille (VI°), France.

The Chauvin-Blache scholarship for 1955 (value 200,000 French francs) is planned so that the recipient may spend three months in one or two (his choice) of the three great French schools of trachomatology in Algiers, Rabat, and Tunis.

This competition is open to all physicians and interns of all nationalities who have had a minimum of two years' work in ophthalmology or an associated science.

Candidates should apply to the Secretary General, Dr. Jean Sédan, 94 Rue Sylvabelle, Marseille (VI°) before January 1, 1955, submitting in triplicate the following information:

1. Details of his civil state, experience, university, and hospital.
2. His reason for desiring this training.
3. His work—ophthalmology, laboratory, and possibly trachomatology—and titles of published papers.
4. Certificates and recommendations from directors of institutions in which the candidate has worked.

The successful candidate must agree to send the secretary general a report of what he has gained from the scholarship and the reflections which his experience during his tenure have inspired. This report may be published in the *Revue Internationale du Trachome*.

Colorado course

A postgraduate course in ophthalmology and the summer convention of the Colorado Ophthalmological Society will be held at the University of Colorado Medical Center, Denver, Colorado, on July 26, 27, 28, and 29, 1954.

The program will consist of lectures, seminars, and demonstrations of interest both to the specialist and practitioner caring for eye diseases. Registration will be open to all members of the society and to qualified physicians on a limited membership basis. Tuition is $40.00. For complete program and details write to: Director of Graduate and Postgraduate Medical Education, University of Colo-

rado School of Medicine, 4200 East Ninth Avenue, Denver 20, Colorado.

Miscellaneous

Lecture tour

Setting a new precedent for Pan-American cultural relations in opthalmology, Dr. William B. Clark, Dr. Howard F. Hill, and Dr. Paul Chandler, as a team, visited Cuba and Puerto Rico where, at the invitation of the local ophthalmological societies, the following program was given: (1) "The selection and preparation of the patient for cataract extraction" by Dr. William B. Clark; (2) "The incision and closure," by Dr. Howard F. Hill; (3) "The management of the immediate and postoperative complications of cataract surgery," by Dr. Paul Chandler; (4) round-table questions and answers.

International Scholars Forum

As all scholars to their sorrow know, high manufacturing costs in the publishing field make it increasingly difficult to place manuscripts likely to have a limited sale. Big commercial houses are more and more unwilling to risk financial loss. University presses, which were once the recourse of the scholar, find it necessary to ask for large subventions and guarantees. The International Scholars Forum has been organized in the belief that many first-rate manuscripts are circulating in vain search of a publisher.

The underlying idea of this series is simply the recognition that publishing costs are much lower on the European continent than in this country. Unfortunately, American authors do not know much about European publishers, and these publishers, for their part, find it difficult to evaluate the American manuscripts submitted to them. The advisory board of the International Scholars Forum has therefore entered into an agreement with Martinus Nijhoff of The Hague to receive manuscripts, appraise them, and make recommendations regarding publication. While the publisher reserves the right of final decision, it is thought that this arrangement will both facilitate the flow of manuscripts and assure other authors in the series of the substantial quality of companion volumes.

Where an American publisher requires an edition of 2,000 or more copies to break even, Mr. Nijhoff is prepared to publish an edition of as few as 500 copies. Authors who, on a realistic assessment of their sales potential, conclude that it will be limited chiefly to libraries and to other scholars in the field, should therefore consider the possibility of submitting their manuscripts for publication in the International Scholars Forum. In addition to extensive European outlets, Mr. Nijhoff has an American outlet. Moreover, he regularly circulates catalogues and announcements of publication in this country. With review copies sent to learned journals, an author should therefore have as large an audience as he could expect with an American publisher, and he would have a substantially larger European audience.

Authors will enter into individual contracts with the publisher. Mr. Nijhoff believes that it will frequently be possible for him to publish without any subvention; where a subvention is asked, it will be considerably less than the guarantee required by an American publisher. Authors who submit manuscripts should understand that European publishing practices differ somewhat from those in this country. While authors are expected to do the main job of proof reading, the publisher is extremely generous about submitting proof, even in the page stage. Costs of correction are borne by the publisher, as far as printing errors in the first and second proof are concerned; authors are charged for the cost of author's correction only. In short, an author who is prepared to take pains on his manuscript as well as on his first and second proof will find the arrangements entirely satisfactory. The finished product will be of high quality, as Mr. Nijhoff has a reputation throughout Europe and the United States for the appearance of his books.

For further information apply to the librarian of The Honnold Library, Claremont, California.

Societies

Eastern Research meeting

The Eastern Section of the Association for Research in ophthalmology met at the Wills Eye Hospital, Philadelphia, on February 18th. On the program were:

Morning Session

8:30 Registration
9:00 Business meeting
9:30 Cataracts in alloxan diabetic rabbits—David Naidoff, M.D., Jefferson Medical College, Philadelphia
9:50 Experimental nutritional cataracts—Lloyd Riggs, Ph.D., Oakdale, Long Island
10:10 Possible role of hyperestrinism in the pathogenesis of retrolental fibroplasia—Bernard Goldberg, M.D., New York Eye Infirmary, New York City
10:30 Correlation between clinical findings and bacteriologic studies of surgical tissue specimens in sinusitis in the study of eye diseases—Merrill Goodman, M.D., New York Eye Infirmary, New York City
10:50 Etiologic diagnosis of uveitis—R. Witmer, M.D., Eye Institute, Columbia University Medical School, New York City
11:10 Laboratory aids in the diagnosis of granulomatous uveitis—William Hart, M.D., Jefferson Medical College, Philadelphia
11:30 Changes in aqueous humor ionic concentration after paracentesis—Fred Sutliff, M.D., and Robert Hamilton, M.D., Temple University Medical School, Philadelphia
11:50 Maintenance of transparency and normal hydration in the corneas of fish and mammals—George K. Smelser, Ph.D., Eye Institute, Columbia University Medical School, New York City
12:10 Carbonic anhydrase inhibitor as a therapeutic

agent in ophthalmology—Harvey Thorpe, M.D., Montefiore Hospital, Pittsburgh

Afternoon Session

1:30 Experimental posterior segment lesions—A. W. Vogel, M.D., Research Dept., Wills Eye Hospital, Philadelphia

1:50 Hyaluronic acid content of the viterous humor —E. A. Balazs, Ph.D., Retina Foundation, Massachusetts Eye and Ear Infirmary, Harvard University, Boston

2:10 Ultrasonic liquefaction of the viterous humor —Anthony Dunn, M.D., Eye Institute, Columbia University Medical School, New York City

2:30 Evaluation of diaparene as an ocular irrigant—J. W. Hallett, M.D., Research Dept., Wills Eye Hospital, Philadelphia

2:50 The utilization of glucose by an alternate metabolic pathway in the corneal epithelium—J. Kinoshita, M.D., Howe Laboratory, Massachuetts Eye and Ear Infirmary, Harvard University, Boston

3:10 Interpretation of monocular, binocular and strabismic vision from an orthoptist's point of view—Fred Brock, D.O.S., New York City

3:30 Effect of steroids on tensile strength of corneal wounds—A. Fink, M.D., and I. Bares, M.D., Cornell Medical School, New York City

3:50 The polysaccharides of the corneal stroma—Claes-Henrik Dohlman, M.D., and Endre A. Balazs, Ph.D., Retina Foundation, Massachusetts Eye and Ear Infirmary, Harvard University, Boston

4:10 Experimental attempts to produce hypersensitivity to uveal tissue—Howard Naquin, M.D., Wilmer Institute, Baltimore

4:30 Tonography in scleroderma—Cyril M. Luce, M.D., Research Dept., Wills Eye Hospital, Philadelphia

At the evening session with the Section on Ophthalmology, College of Physicians of Philadelphia, Dr. C. Wilbur Rucker, Mayo Foundation, Rochester, Minnesota, presented a paper on "Ophthalmoplegias of peripheral origin."

Midwest Research officers

Dr. Paul W. Miles of Washington University, Saint Louis, was elected chairman of the Midwest Section of the Association for Research in Ophthalmology at the annual meeting February 7, 1954, at the University of Chicago. He succeeds Dr. Theodore F. Schlaegel of Indiana University. Dr. Arlington C. Krause of the University of Chicago was elected vice chairman to succeed Dr. Miles. Dr. Frank W. Newell of the University of Chicago is secretary-treasurer of the section.

New York alumni meeting

The Alumni Association of the New York Eye and Ear Infirmary will hold its spring scientific program on Monday and Tuesday, April 19th and 20th, at the Academy of Medicine, 2 East 103rd Street, Room 448, New York. The morning sessions will start at nine, the afternoon at two.

Los Angeles officers

The Los Angeles Society of Ophthalmology and Otolaryngology has elected the following officers for 1954: President, Dr. Harold Owens; secretary-treasurer, Dr. Robert A. Norene; chairman of Section on Ophthalmology, Dr. Sol Rome; secretary of Section on Ophthalmology, Dr. Wendall C. Irvine. The ophthalmology section meets at the Los Angeles County Medical Association Building, 1925 Wilshire Boulevard, Los Angeles, at 6:00 p.m., the first Thursday of each month from September to June inclusive.

Nassau meeting

Dr. Harold W. Brown presented a paper on "Paralysis of the inferior oblique muscle," at the February 22nd meeting of the Nassau Ophthalmological Society.

Oxford Ophthalmological Congress

The Oxford Ophthalmological Congress will convene at Balliol College, Broad Street, Oxford, on the evening of July 4th, and meetings will be held July 5th, 6th, and 7th in the lecture hall of the Sir William Dunn School of Pathology. The Doyne Memorial Lecture will be delivered on July 6th, in the morning, by Mr. Frederick Ridley, London. The Monday (July 5th) morning discussion will be on "The significance of macular changes." The introducers will be Mr. P. Jameson Evans, Birmingham, Mr. R. Davenport, London, and Mr. L. H. Savin, London. Wednesday morning's discussion on "Postoperative ophthalmic care" will be opened by Mr. F. A. Williamson-Noble, London, and Mr. J. G. Drummond Currie, Cheltenham. Dr. Edmund B. Spaeth, Philadelphia, Mr. M. Duthie, Manchester, Mr. H. Campbell Orr, Wolverhampton, Mr. G. T. Willoughby Cashell, Reading, Sir Henry Holland, Farnham, and Mr. M. J. Roper-Hall, Birmingham, will present papers.

Irish Ophthalmological Society

The annual meeting of the Irish Ophthalmological Society will be held in Dublin on April 29 and 30 and May 1, 1954. The Montgomery Lecture entitled "Some recent contributions to the diagnostic problem of glaucoma" will be delivered by Professor Bietti, Parma, Italy.

New Orleans alumni meeting

The annual meeting of the New Orleans Eye, Ear, Nose, and Throat Hospital Alumni Association will be held in New Orleans at the hospital on April 5, 6, and 7, 1954. Dr. Samuel Fomon of New York, will deliver the Clyde-Lynch Memorial Lecture and participate in operative demonstrations. All alumni and others interested in eye, ear, nose, and throat are invited to attend.

Personal

On Monday evening, April 19th, a dinner will be given at the Harvard Club of Boston in honor of Dr. Frederick H. Verhoeff on the occasion of his 80th birthday.

The Purpose of the Guild

- The aim of the Guild of Prescription Opticians of America is to advance the science of ophthalmic optics through the development of a country-wide ethical optical dispensing service that comprehensively meets the needs of the Eye Physicians and their patients; and to educate the public to the fact that the Eye Physician-Guild Optician type of eye service truly renders the most desirable form of eye care.

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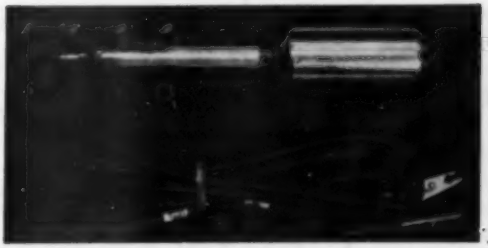

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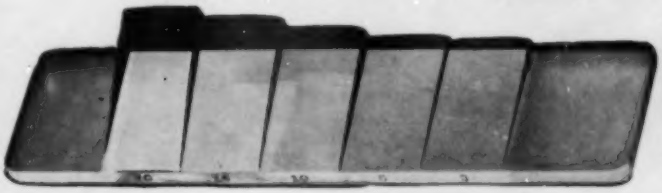

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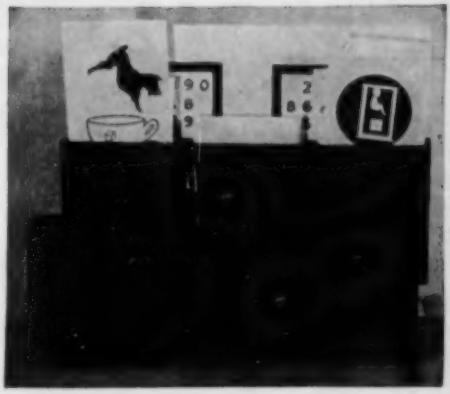

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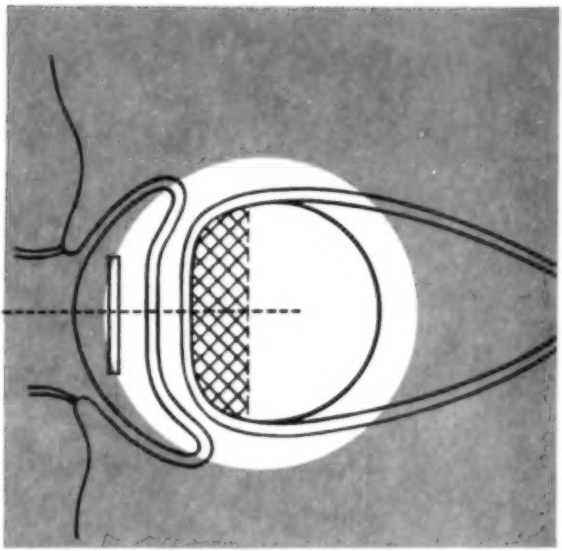

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